MANUAL FOR THE ESSENCE INDUSTRY

COMPRISING THE MOST MODERN METHODS FOR MAKING ALL KINDS OF ESSENCES FOR LIQUORS, BRANDIES, LIQUEURS, AND ALL ALCOHOLIC DRINKS, FRUIT-JUICES, FRUIT-WINES, AND JAMS. ALSO, MANUFACTURING MINERAL WATERS; ESSENCES OF FRUITS AND OTHER VEGETABLE RAW MATERIALS; FANCY LEMONADES OF EVERY KIND; ESSENCES FOR CONFECTIONERY, PASTRY, AND THE KITCHEN; MANUFACTURING COLORS AND PERFUMES, AS WELL AS COSMETICS AND SOAP PERFUMES WITH A FULL DESCRIPTION OF RAW MATERIALS AND OF LABORATORY PRACTICE

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MANUAL FOR THE ESSENCE INDUSTRY

PART I

THE TASTE, AND THE TRANSFER OF FLAVOR TO FOODS AND BEVERAGES

THE FUNCTION OF THE TASTE

The taste is one of our five senses, and however highly cultivated, it is the most sluggish of them all. It is allied to the sense of smell. Both the taste and smell are nerve sensations caused by ethereal vibrations, but those of smell are shorter, and affect the nervous system before the object causing them is observed, while the taste requires the immediate contact of the substance with the tongue.

Flavor is of great importance to nutrients, although it has no direct influence on the nutritive value of the foods. It is but a valuable aid to make them enjoyable, and its first action is directed to the nerves of the tongue. These nerves are very sensitive to agreeable or disagreeable tastes, and this sensitiveness affects the nerves which excite the appetite and stimulate the activity of the stomach. A bad taste is repulsive to the stomach. On the other hand, a stimulating effect on the digestive functions is most valuable.

The taste is not itself a substance, but is a special property of substances, to a certain extent a phenomenon of energy recognized by our nerves, and it is for this reason that it is possible to transfer the taste, or flavors, to our foods and beverages. The flavoring properties of the raw materials of whatever kind, and in convenient form, can thus be transferred to the various foods intended for our nourishment or enjoyment, and this is the chief object of the essence industry.

THE KINDS OF TASTES

First and foremost, four main kinds of tastes are to be distinguished. These are the *sweet*, *sour*, *bitter* and *salt* tastes. Their strength and intensity are dependent upon concentration or purity, and are influenced by a certain class of aromatic flavors, which are directly the opposite of the above standard kinds of tastes. The *aromatic* taste is derived from vegetable substances, and varies with the different kinds of materials. It usually accompanies the other tastes, and modifies them.

With the exception of saccharin, the *sweet* taste is due to sugar, usually *cane sugar*, as only in certain cases is dextrose (starch sugar) used, and then only for the sake of cheapness. *Fruit sugar*, as invert sugar, beside dextrose, is a constituent of fruits, and imparts to them their sweetness. This fruit, or *invert*, sugar, however, has nothing whatever to do with the special flavor of the fruits, the flavor depending upon the aromatic substances peculiar to the various fruits.

The *sour* taste is due to acids. The inorganic acids are the stronger, but because of their toxicity they are unsuitable for use in foods. The acid most employed for kitchen purposes is acetic acid in the form of vinegar, while for refreshing beverages there are used the so-called fruit acids, as citric and tartaric acids, which are prepared by chemical treatment of the natural acid constituents of lemon juice and grape juice. While the sweet taste is generally designated as agreeable, the sour taste is limited in employment, and is very often agreeable only when modified by sweet additions. In general the sour taste is refreshing, as in salads and lemonades. It relieves the thirst, and when sugar is added, the absorbability of the acids is increased.

The *salty* taste is necessary for foods, but scarcely so for beverages. The addition of table salt completes the daily intake of the various salts or nutrient salts contained in all vegetables, fruits and water. Table salt increases the palatability of foods, and replaces that daily eliminated from the system. Besides table salt, various inorganic salts are ingested in the form of natural or artificial mineral waters, and their effect is to regulate the gastric and intestinal functions.

The *bitter* taste is, regarding its stimulating effect, similar to that of the aromatic substances, which it accompanies very often. Purely bitter substances, however, have a decidedly disagreeable

taste, although they strongly excite the appetite, whereby they increase the amount of food consumed and promote digestion; through habituation to their use, however, their effect may be lost. The action of bitter substances is exerted only when the stomach is digesting food, and therefore sugar is usually added to such bitters to make them more absorbable. Sugar is added in this case not only as a corrigent, but also for the purpose of affording an object for the gastric function.

Sugar is used in foods and beverages not only to render them palatable, or as a taste corrigent, but because it is esteemed as a nutritive factor. Sugar is often used to cover a disagreeable taste or improve it. In beverages it is usually the only constituent of nutrient value, and is besides adapted to stimulate the nerves of digestion.

Quite different from the above-named four standard types is the *aromatic* taste. While the above-mentioned tastes are, to a certain extent, fundamental in character, the aromatic taste is exceedingly varied in character. Being without independent individuality, it leans usually on one or another of the other tastes mentioned, and thereby effects changes in the entire character of the taste. The aromatic taste must further be differentiated into *extractive* and *volatile* flavors. Although the number of chemical elements concerned in the composition of these aromatic substances is rather limited, the variety of such substances is almost inexhaustible, and they are derived from the vegetable, and, to a much less extent, from the animal, world.

The extractives are originally present in solution in the cell sap, from which they are obtained by the process of extraction; they are not volatile, and hence remain behind when the solvents employed are evaporated off. Such aromatic extractives are widely distributed in the vegetable kingdom, but their taste is so closely allied to that of the purely bitter principles that a difference is often hardly noticeable. The volatile aromatics, on the other hand, have a far wider field of usefulness. It was customary to believe that these were derived from the volatile oils, which constituted waste products of the plant growth and food assimilation. Strictly speaking, it is not the volatile oils, but their active constituents, to which the flavors are due. Some of them are present in the plant in large quantity, while many may be obtained in the form of volatile oils, even though these are not the bearers of the

taste itself, because they are accompanied by various volatile substances as terpenes, etc., which lack the odor or taste of the raw materials, and which can be removed. In many other cases, certain plant products, *e.g.*, from certain fruits, possess a very strong odor and taste, even though the carriers of these cannot be isolated as is done with the volatile oils. In such cases the only recourse is to transfer the taste to another medium. This is effected in the essence industry either by extraction with alcohol, usually by distillation, or less frequently by shaking out with other volatile media. By distillation of the raw material, the flavoring substance is obtained in purer form, and in any concentration desired, because free from any extractive matter. In many cases the character and composition of flavors which cannot be isolated in pure form are unknown, and even in the better known cases the aromatic substances are accompanied by some unknown peculiar substances, which, though lacking the characteristic aroma, exercise a valuable influence on the fine quality of the taste or bouquet.

The effect of aromatic substances is always stimulating. A large number of them are used as spices in the household, while others are used only for alcoholic beverages, and the most delicate flavors, particularly of fruits, are preferred as flavors in the manufacture of lemonades. The stimulating effect is first exerted on the nerves of the tongue, although the odor may already have agreeably excited the appetite. These properties are transferred to foods and beverages in order that they may increase the appetite and help the digestion.

THE HARMONY OF THE TASTE

In general the flavors are necessary companions of foods, etc., although they have nothing to do with nutrition itself, or at most only render foods enjoyable to the taste and stimulate digestion. They make the food or beverage pleasant and agreeable, and are hence worth careful consideration. We know that not every taste is agreeable, and there are many which are nauseous and disagreeable. Of course these are not in question. But every person possesses an individual taste, and it is difficult to satisfy everyone. The human taste is very sensitive to a disagreeable, or "false," taste, and it is the first task to avoid this.

As in music or painting, various but distinct tones are to be

distinguished, which, mixed with other tones or colors, afford new tones or colors, but not all are adapted to afford harmonic tones or complemental colors. Harmony requires adherence to certain rules which, if disregarded, lead to dissonances to which even the unmusical will object. Although such rules regarding the taste are not quite so pronounced, nevertheless they exist, and over them the tongue alone is the judge.

We speak of a so-called *leading taste*, when a certain taste predominates, although other flavors present vary the taste. On the other hand the *general taste* is one where the constituents afford a conglomerate flavor wherein no one in particular predominates. This harmonious blending imparts a "full" taste, which is generally agreeable. A most serious fault is the presence of a *false* taste in any composition, *i.e.*, the employment of improper flavoring substances, and the manufacturer should take particular care that compounds do not differ in taste from that to what the public is accustomed in this regard. The flavor must always correspond to what people imagine regarding such flavor.

THE TRANSFER OF TASTE TO OTHER GOODS

Most of our flavors are derived from the vegetable kingdom, and they are most pronounced in fresh plants or their parts. Usually they exist ready formed in the plants, and only rarely are they formed afterwards, as volatile mustard oil or almond oil.

There may also be a mechanical transfer, as where the vegetable products are added in their proper form to foods, as when spices are used, or sugar for sweetening, or vinegar for acidulating, or fruit acids for lemonades. This is also the case when natural products are used, as fruit juices, or fermentation products, as wine or alcohol; and when such products are added to foods or beverages to impart a certain taste, it is merely a mechanical transfer.

The *extractive* taste is derived largely from plant juices, from which it is extracted by suitable means. When extracted, by any way, as by means of water or alcohol, the substances formerly dissolved in the natural plant juice are again dissolved, and when the solvent is evaporated, the non-volatile part remains, the residual extract then containing various substances such as nutritive salts, certain acids, coloring matters, sugars and more or less bitter principles. The fact that extractives are not volatile, per-

mits their isolation and concentration by extraction methods alone.

On the other hand, in the concentration of such preparations as fruit juices, only an evaporation is required to remove the water present. The result is also an extract. Of the extractives present in each case there are some which are of little importance, and some which may be even directly objectionable. It is hence important to separate the less necessary substances, and to isolate as far as possible the useful. This is effected by a choice of the proper solvent. As most of the flavors suitable for our use are soluble easily in alcohol, the latter is mainly used as a solvent, and in varying concentration according to the character of the substance to be treated. However, the concentration of such extracts is limited according to the amount of total extractives capable of being dissolved, and the solubility of the individual substances. In some cases the carrier of the taste can be isolated, as for instance alkaloids, such as quinine, but for purposes of foods and beverages such isolations are seldom required, because the taste is not dependent upon such constituents alone, but is rendered more agreeable by other accompanying substances. Further, pungent aromatic substances, such as capsicum, ginger, galanga root and others, are also extractive in character. Most spices, too, even though their aromatic principle is of volatile character, contain valuable extractives which enhance the spice value, and this is the reason why spices are used in substance, and not as an essence, even though they could be replaced by the appropriate volatile oil. Most of the extractives are accompanied by aromatic constituents, such as volatile oils, but as well suited as the latter would be, the extractives are far better because they are the bearer of the total valuable effects.

The volatile aromatics are more or less volatile oils or similar compounds having the constitution of esters, alcohols, aldehydes, etc. These aromatics are all volatile, and can be separated by distillation, or transferred to any suitable medium, such as alcohol. On distillation with steam, the aromatic substances, in spite of their higher boiling-points, are mechanically carried over with the steam, and as they are not soluble in this medium, they separate when the steam is condensed. If alcohol is employed, the vapor of the aromatic is also mixed with the alcohol vapor, but as essential oils are soluble, at least partly, in alcohol, the result will

be a transfer of the flavor to the alcohol. This is particularly the case when only traces of flavor are present, as in fruits, when the volatile matter cannot be isolated like the volatile oils.

The volatile oils are direct flavors, and not transfers as in the above sense. When the flavor is mixed with other substances, as alcohol, a transfer of the flavor takes place. The character of the volatile flavors is such that they can be separated from their raw materials, and free from extractives, and that they can be transferred without loss to yield their taste to any preparation, such as alcohol, beverages of all kinds, confections, and foods of every sort.

The medium for transferring flavors is called in general "*essence.*" This word is derived from the Latin "esse," to be, *i.e.*, it is, or will be, the essential part of something. In the former case the term "essence" refers to the source; in the latter, the purpose for which it is used. Sometimes both interpretations agree, as for instance a raspberry essence will be made from raspberry fruit and is to be employed for imparting a raspberry taste or flavor to any substance. However, many essences bear the name only of the product which is to be made, and the essence, which may be synthetically made, bears no relation whatever to the natural fruit product, as for instance in the case of artificial raspberry essence; then again, rum essence is not made from rum, although it is employed for making rum-like substitutes.

Volatile oils possess the advantage of higher concentration, but essences, which are distilled with alcohol, possess the advantage of finer taste, because the heat often impairs the fine flavor of volatile oils, while the terpenes, as regular constituents of volatile oils, are most objectionable as they cause cloudiness because of their poor solubility in weak alcohols. The terpenes are not at all bearers of any specific, valuable taste, and are therefore worthless. It is possible to remove them, with the result that terpeneless oils are obtained. These may be regarded as the real essential constituents of the common volatile oils, but such concentrations are isolations, and have nothing to do with the principles covering the manufacture and use of essences.

The flavor of some flowers, and particularly of nearly all fruits, except the citrus fruits, is very delicate, and is not suited for isolation in pure form. Every fruit essence is only a diluted transfer of the volatile flavor of fruits to alcohol. Even in the highest concentration, as for instance in the so-called fruit flavor oils,

the flavor is only an extractive substance, exact knowledge of its contents being lacking.

However, these strong concentrations of fruit flavors are also usually diluted for taste purposes, to form essences of one kind or another.

The essences of the trade are all concentrations of the flavors of vegetable substances, however manufactured, and their manufacture is in every case dependent upon their future use.

ORIGINALS, SURROGATES AND IMPROVERS OF THE TASTE

When any flavor is transferred in any manner from raw materials to an essence, and is destined to afford the flavor without the aid of any other preparation or substitute, the product is said to be an *original* one. When, instead of genuine raw materials, any other substance is substituted, or any such is employed in conjunction with it, the result will be a *surrogate*. This term, however, gives rise to certain inconsistencies. Thus, supposing a flavor has been found to be due to woodruff; it will be quite immaterial whether woodruff or tonka beans are used, as both contain as the flavoring substance cumarin. The same is the case when the flavors are manufactured artificially and when their chemical constitution is the same as that of the natural flavors, *e.g.*, vanillin or cumarin, in which case the artificial substance is not a surrogate at all. It is also incorrect to say that any fruit essence made from fruit residues alone is a surrogate as compared with one made from the whole fruit. The aroma is widely distributed through all parts of the fruit, and it is therefore immaterial from what part of the fruit the flavor is isolated as an essence. A preparation made from residues is not in every case a surrogate. It would be one if, for instance, genuine brandy were obtained from other than the usual materials. Wine brandy cannot be manufactured from wine lees; and saccharin employed besides sugar would be a surrogate. In most cases any surrogate would be a *misbranding*, and would therefore not be allowed.

On the other hand *imitations* are often to be found. Of course any imitation must be declared so that the public at all times is able to distinguish between the originals and imitations. The latter are usually cheaper, but not always. On the other hand, substitutes are to be differentiated from imitations, as, for instance, artificial lemonades made from essences, which, though they copy

the natural lemonades, are free from their faults. An imitation is intended to resemble the original, while made by processes free from the technical difficulties involved in making the original, as, for instance, using artificial substances to make artificial rum.

In the beverage industry, the art of *refining* plays an important role, for instance, when genuine products receive additions which improve the taste but without in any way covering it. *Typages* are such means of refinement. They are destined, when added, to afford a definite, usual, or even a special, type of beverage. Such typages always represent an individual taste, but should never replace or fortify the original taste, but only modify it. Similar are the so-called "*bouquetage*" preparations. They also should never substitute the taste itself, but round it out and give it some special flavor. During the distillation it often happens that some flavoring constituents are destroyed because of their delicacy. To avoid this, the manufacture is carefully conducted by special methods, as using low temperatures, etc. However, it will be found a good practice to enrich the volatile flavor with such aromatic substances as help to express the full taste.

Another method is the "*fixage.*" Most flavors are very volatile and also very sensitive. To render such flavors more permanent to the taste, it is usual to make discreet additions of volatile oils, high-boiling ethers, artificial flavors, etc. They retain the taste on the tongue and prolong its effect on the nerves of taste. However, fixing agents and also bouquetages should never be employed in such amount as to overbear the original taste or to imitate it in any wise.

Lastly, *artificial fortifiers* usually have no other purpose than to imitate the taste and to cover up any defect. In most cases it will be necessary to make a declaration regarding a product so treated.

ALTERATION OF THE TASTE BY CHEMICAL OR PHYSICAL MEANS

Flavoring substances are products of the living plant, and with the harvesting and the interruption to growth, the parts carrying any taste begin at once to lose in flavor. Of course the loss varies regarding the time when it is directly noticeable, but the development of flavor is interrupted completely. The flavor of fruits is developed when the fruits are ripened, and it is enriched by the action of sunlight, especially on that side where the light falls

and that side is then usually more highly colored. Heat and sunlight develop the flavor. But, on the other hand, heat destroys the flavors if the fruit is fully ripe. The delicate flavors, as of the strawberry, and also the volatile oils, are very sensitive to heat. For example, take the fine flavor of lemon peel usually obtained by expressing the oil. When fresh lemon peels are distilled to obtain the volatile oil, the result is an oil of very low quality. The same is the case when expressed lemon oil is rectified — the oil obtained will have lost its fine flavor.

Most volatile oils are not so sensitive, but in very many cases some alteration in the flavor will be observed. It is therefore best to transfer the flavor by distillation with alcohol in the manner that essences are generally manufactured. The temperature should be lowered by maintaining a vacuum, whereby the flavor is isolated in a much more natural condition than at the ordinary temperature. Some flavors, such as pineapple, strawberry, banana and peach, do not bear distillation at all, or but very badly, and hardly without loss of quality of product.

Besides the original taste some *by-taste* is often developed by heat. This by-taste is usually unpleasant, but frequently, however, it is very desirable, as in the case of roast meats, roasted coffee, etc.

The air, or rather, the oxygen of the air, is the cause of a rancid taste. This results from oxidation, which causes the terpenes of the volatile oils to resinify. Again, fermentation has a peculiar effect on the aroma of fruit. Some flavors are greatly improved by it, as apples and cherries, and others entirely destroyed, as, for instance, strawberry, pineapple, banana, peach, etc. Others are partially influenced, and even the most stable give evidence of some change. Those fruits which are sensitive to heat are also sensitive to fermentation. The alteration in taste in such cases is due to a chemical decomposition of the natural flavors, and new flavors are formed, some of which may have a better taste than the original, as for instance with black currants, and sometimes the new taste suppresses the agreeable original taste.

Such possibilities must be borne in mind when manufacturing essences, and therefore the methods employed are very varied, because it is important to use the most practicable to exhaust the raw material to the greatest extent and at the same time to obtain the most natural reproduction of the flavor as regards fineness and utilizability.

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PART II

THE RAW MATERIALS YIELDING THE DIFFERENT TASTES

A. Fruits and Other Parts of Fresh Plants

The value of the various fruits depends in general upon the wholesomeness of their juices, the constituents of which are fruit acids, sugar and certain salts. The varied taste is afforded by the fruit flavoring which becomes more pronounced when the fruit ripens. The pleasant taste determines the employment of the fruit either as such, or in the form of marmalades or jellies, and particularly as fruit juices, this last indeed being specially utilized in a particular industry. Fruits of all kinds are also used in the manufacture of essences, for which their flavors lend themselves. In Parts IV and V the manufacture of such juices as well as fruit essences will be fully detailed.

The other plant portions are scarcely, if at all, used, except as table or kitchen vegetables, for which purpose the plant parts are dried by varied methods, and kept ready for use in the form of drugs.

B. Drugs

1. Collection and Preparation of Drugs

All plants, or at least certain parts of them, contain specific substances upon which the taste or odor depends, and which are of importance in the manufacture of essences; other substances are also present which, though of less importance so far as taste and flavor are concerned, may be of technical or medicinal value. Every plant family elaborates specific substances, and the mode by which this is effected depends upon the life history of the plant, the various substances of most interest to us being, in fact, considered to be by-products of the plant metabolism. Those substances which the plant organism cannot utilize for its growth and development are deposited in the cells of some part of the plant as by-products. To these substances belong the volatile oils, and

also other substances having taste or odor. The quantities of such by-products depend upon the character of the plant family, as well as upon the cultivation, development at time of collection, period of the year, and the prevailing weather. In most cases plants growing wild are richer in quantities of such substances, while in cultivated plants the flavor is in many cases better developed. There is therefore a choice to be made, according to the character of the plant, as to whether wild or cultivated plants are to be preferred. Aromatic substances are present in largest quantity at the flowering period, while with extractives this is the case at the period of ripening, although during a dry spell the yield of extractive is diminished. Then again the character of the soil is also important, as well as the time of maturity.

As a rule drugs are collected at that period of maturity when the substances desired to be utilized are developed to greatest extent. The freshly collected plant portions are first dried, and so far as possible without the aid of artificial heat, best in the shade, the drying being facilitated by a current of air. Only such drugs as are aromatic, or which are very fleshy, are dried by the aid of artificial heat. By drying the plant parts are freed from their greater portion of water content, and the extractives present in the cells become dried. The volatile oil content is diminished partly by volatilization, partly by resinification, whereby the odor and taste, at least so far as quality is concerned, are impaired.

The dried drugs are then garbled, and any impurities and unimportant portions, such as stems, etc., removed, or, in certain cases, particularly good portions picked out for special use. Before use, the drugs usually require to be comminuted. This is usually effected mechanically by cutting or chopping machines, and the comminuted drug is then sifted through sieves of various degrees of fineness. In the manufacture of essences, the drugs used are cut as finely as possible, but as free from fine powder as possible.

Seeds, dried berries, etc., are best used in crushed form, the broken down cell walls facilitating the subsequent extraction Drugs in powder form are hardly, if at all, used in the essence industry. Such powders are often obtained from the comminuted drugs, but they are mostly used only pharmaceutically.

In using drugs in the manufacture of essences, it is always of

the greatest importance that the drugs be used in properly comminuted form in order that the menstruum employed may pass through the cell walls uniformly, and for this it is important to remember that it is not a question as to how finely the drug has been ground, but as to how *uniformly*.

2. Constituents of Drugs

The volatile flavors depend, as is well known, on the volatile oils, and upon these the value of the spices is based. Only in certain cases is their effect enhanced by extractives, as in the case of ginger or pepper. The so-called aromatic drugs all contain volatile oils, but their taste is in most cases improved by extractives of usually more or less bitter taste. Only in rare cases do we find a sweetish taste, as, for instance, with anise, coriander and fennel. Another group of drugs have a purely bitter taste, and many of these drugs have a cathartic action, as, for instance, aloes and agaric, while others are exceedingly active, but not aromatic. Still another group of drugs possesses a predominant bitter taste, which, however, is modified by aromatic substances present.

Regarding substances having a cathartic action, it must be remembered that certain countries forbid the use of aloes and agaric, and to some extent also cinchona bark. In such cases it will be advisable to replace such bitter substances by others which are admissible and which are always available. Even the usual cathartic drugs, such as rhubarb and manna, are also best discarded.

Certain drugs owe their employment to their stimulant action, as coffee, tea and chocolate; the flavor of coffee and chocolate is developed by roasting before they are used as beverages. Certain drugs contain specifically active substances, as vanillin in vanilla bean, cumarin in tonka bean and woodruff, the so-called almond taste of benzaldehyde in seeds of stone fruits, saponin in soap root, etc. The extractives, particularly of the bitter drugs, frequently contain alkaloids, and the number of bitter drugs could be increased indefinitely in this respect were they not to some extent poisonous. Among the bitter substances are also certain glucosides, while others belong to the group of true bitter substances, the composition of which in general is but little known.

The following table classifies the drugs according to their taste:

3. Table of Drugs According to Their Specific Taste

[( ) = the carrier of the bitter taste]

(a) *Bitter Drugs with Little or No Aromatic Taste*

Very Strong and Drastic Bitters:

Agaric (Agaricin).
Aloes (Aloin).
Chiretta Herb.
Quassia Wood (Quassin).
Wormwood (Absinthin).

Strong Bitters:

Centaury herb (Erythrocentaurin).
Colomba root (Calumbin).
Gentian root (Gentianin).
Holy Thistle (Cnicin).
Cinchona bark (Quinine).
Simaruba bark (Simarubin).

Weak Bitters with Aromatic Taste:

Angustura bark (Cusparin).
Cascarilla bark (Cascarillin).
Yarrow (Achillein).
Curaçao peel (Hesperidin).
Hop (Hop bitter).
Iva herb (Ivain).
Orange, bitter; peels and unripe fruits.
Rhubarb (Rhein and Emodin).

(b) *Aromatic Drugs with Little or No Taste*

Strong Aromatics with Slightly Bitter Taste:

Angelica root and seed.
Balm Mint.
Calamus root.
Caraway.
Cubebs.
Elecampane root.
Juniper berry.
Laurel berry and leaves.
Lemon peel.
Thyme.
Origanum.
Lovage root.
Marjoram.
Peppermint.
Pepperwort.
Pimpinella root.
Roman Chamomile.
Rosemary.
Sage.
Valerian.
Zedoary root.

Weak Aromatics without Bitter Taste:

Arnica flowers.
Balm leaves.
Celery seed.
Common Chamomile.
Orris root.
Tansy.
Elder flowers.
Guaiac wood.
Lavender flowers.
Musk seed (abelmoschus).
Sassafras wood.

Aromatics with Peppery Taste:

Capsicum.
Galanga root.
Ginger.
Paradise grains.
Pepper, black and white.
Pyrethrum root.
White Cinnamon.

True Spices:

Allspice.
Cardamom.
Cinnamon, Cassia and Ceylon.
Cinnamon flowers.
Cloves.
Mace.
Nutmeg.
Vanilla (no volatile flavor).

Aromatics with Sweet Taste:

Anise and Star Anise.
Carob.
Coriander.
Fennel.
Licorice root.
Manna.
Sweet Orange peel.

Aromatics with Specific Taste:

Bitter Almond Taste.
Bitter Almonds.
Apricot Kernels.
Common Laurel leaves.

Cumarin Taste.
Woodruff.
Tonka beans.

Tannic Acid Taste.
Oak bark.

Animal Aromatics.
Musk.
Castor.
Ambergris.

(c) *Stimulant Aromatics*

Containing Caffeine.
Coffee.
Tea.
Kola.

Containing Cocaine.
Coca leaves.

(d) *Coloring Matters*

Alkanet root (red).
Huckleberry, black (red).
Buckthorn berry (yellow).
Campeachy wood (logwood) (blue).
Catechu (brown).
Cochineal (red).
Cudbear (yellow).
Curcuma root (yellow).
Pernambuco wood (red).
Poke berry (red).
Kino (red).
Mallow flowers (red).
Safflower (Carthamin, yellow).
Saffron (yellow).
Santal wood (red).
Yellow wood (yellow).

C. The Volatile Oils

1. Manufacturing Methods

(a) *Expression*

The peels of the citrus fruits, *e.g.*, orange, lemon, lime and bergamot, are particularly adapted for obtaining these oils, which are present in so large a quantity in the epidermis of the ripe fruit that they can be obtained by expressing the rasped peels. For this purpose the peel is expressed by hand against sponges, which absorb the oil, and yield it again on being expressed. The raw oil so obtained is then freed from pectinous matter and water by sedimentation and filtration. The peels, which have thus only partially yielded their oil content, are now subjected to steam distillation, whereby a second quality oil is obtained. The oils of the citrus fruits contain but very little of the true carrier of the taste; thus lemon oil contains only about 3.5%, and oranges and mandarins only 1.6%, and these are besides exceedingly sensitive to heat, hence the flavor of the distilled or rectified citrus oils is not so pure.

(b) *Distillation and Rectification*

During distillation the volatile oils pass over with the vapors of the distilling medium with which the oil vapors mix, but separate as the vapors of the distilling medium condense, provided the medium be not a solvent of the oil. The volatile oils are obtained exclusively by distilling with water or steam, and in the latter case even under pressure, by which means thorough exhaustion is accomplished. The rapidity of the process depends upon the kind of volatile oil, and the product itself is not uniform during the distillation. At first the more volatile fractions pass over rather rapidly, while the less volatile pass over later, more and more slowly. The condensed liquid, carrying the oil with it, is collected in Florence flasks, of which, for the sake of safety, a number are arranged in series to act as receivers. The yield of raw oil varies according to the raw material. So far as possible, fresh plant portions are used because these yield an odor truer to nature, and because they can more easily be exhausted. The volatile oils from spices and tropical products are usually obtained prepared by the aborigines by primitive methods as raw oils, and are obtain-

able as such in the market. It is then the province of the volatile oil refiner to further treat the raw product.

Apart from any mechanical impurities it may contain, the raw oil contains a number of volatile constituents which pass over into the distillate. As the volatile oils are not distinctly uniform substances, but consist chiefly of two groups, one the characteristic taste carrier and the other the so-called terpènes, it is quite possible to improve the quality of such an oil by partially removing the valueless constituents, and this is done by rectification. Here it must be remembered, however, that besides the constituents upon which the characteristic odor and taste depend, there are present other substances also, about which little is known, and which to a certain extent may advantageously improve the taste, or else deteriorate it. The first group is of very sensitive character, and is particularly easily decomposed by heat, the flavor then passing into an ordinary one, and it is for this reason that it is advantageous to distil the plant portions with alcohol, which permits these sensitive substances to be obtained unchanged. The less agreeable substances are usually very volatile, and pass over with the lighter portions of the distillate received first. Sometimes, however, they consist of resinous substances which are less volatile, and which hence remain in the retort when rectifying the oil, or are obtained in the last portions distilled off.

The rectification is effected with the aid of water, and employing a still provided with a return tube. The distillate is first received in a Florence flask in which the water condenses, and the volatile oil then collects on the surface of the water. As usual, the more volatile fractions pass over first, and consist chiefly of terpenes and less valuable flavoring substances, as the valuable constituents are much less volatile. The manufacturer may thus exercise his judgment as to the quantity of the first run to remove for the purpose he has in view. The true rectification product consists of the middle run, of the desired length of time; towards the end of the run it is customary to interrupt the distillation and collect a third portion of distillate, which, however, in most cases is much poorer, and contains foreign flavors. The first and last portions of distillate are collected and rectified by themselves in order to obtain their valuable constituents, if any. In some cases the rectified oil is rectified once more, or several times, particularly where very fine oils are desired. In

every case the quantity of the distillate is subject to the judgment of the distiller, and without any objection being possible regarding the purity or quality, so far as no specially guaranteed content of certain constituents is in question.

The so-called concentrated oils are also obtained by rectification, but in a vacuum without the use of water. With them, the object is to separate the first run, consisting of terpenes, from the middle run, which is rich in the substances carrying the flavor; the high-boiling after-run is much less valuable. In this case also the quantity to be separated is a question of individual judgment, and such oils have the sole advantage of having been partially deprived of valueless terpenes. A more thorough treatment, however, will be described later when treating of the methods of obtaining terpeneless oils.

Certain flavors, such as caraway and anise, contain the flavoring agents, anethol and carvone, in large quantity, and as these have quite definite boiling-points, the substances may be obtained in technically pure form for commercial purposes by simple fractional distillation.

In some cases the volatile oils are bleached, as is the case with anise and peppermint oils; and this is effected only by exposure to light in small, white bottles.

(c) *Extraction*

This method is merely a process of extracting aromatic constituents, using a solvent in which the volatile oils are soluble. For this purpose there are used chloroform, petroleum benzin, carbon tetrachloride, etc., which dissolve out the volatile oil without taking up any notable quantities of other extractives. By proper methods the solvent is distilled off, and the extracted oil remains as a residue. This method is particularly adapted for use with fresh flowers, and other substances containing relatively small quantities of oil.

2. Composition of Volatile Oils

The volatile oils consist of various valuable constituents carrying the odor and taste, all of them containing oxygen, and accompanied by oxygen-free terpenes (hydrocarbons) and some resinous or waxy impurities. The terpenes are always present in oils expressed from peels, and interfere with the perfect solubility

of the oils. And even in rose oil or neroli oil traces of wax occur Some resinous matter is usually present in the raw oil, and may also develop in the oil itself through resinification. The terpenes are present in varying quantity, as the following table will show, and boil at lower temperatures (at about 370° F.). The allied group of sesquiterpenes, which boil at about 500° F., also belongs to the valueless constituents. Both of these have an aromatic, but not specific, odor, and but little taste, and are soluble in very strong alcohol, but yield cloudy mixtures with weaker alcohols. It is hence the aim in the essence manufacture to free the essences from terpenes.

The characteristic carriers of the taste may vary greatly in nature. In very many cases they may be designated according to their chemical composition. Among the foremost are the alcohols, designated by the suffix "ol." To these belong anethol in anise oil, methol in peppermint oil, linalol in bergamot and lavender oils, geraniol in rose oil, etc. The phenols, compounds closely allied to the alcohols, are represented by eugenol in clove oil, and thymol in thyme oil. These and other alcohols correspond to a number of aldehydes, bearing the suffix "al," as citral and citronellal in the citrus oils, and also cinnamaldehyde in cinnamon oil, and benzaldehyde in bitter almond oil. Of course, the alcohols may form esters, and in fact such compounds of alcohols with organic acids are suitably designated as salts of the acid, the alcoholic base bearing the ending "yl," as linalyl acetate in bergamot and lavender oils, menthyl acetate in peppermint oil, etc. A number of the taste carriers consist of carvones, with the suffix "one," as carvone (improperly carvol) in caraway oil, menthone in peppermint oil, and thujone in absinthium oil. The terpenes, too, are designated as light oils, and the general ending "ene" sufficiently designates their character, as pinene, citrene, carvene and thymene. The quantity of the true carrier of the flavor or taste determines the value of the volatile oil, but in many cases the qualitative determination is also indispensable.

3. General Methods of Examination

The volatile oils are usually costly substances, and hence subject to adulteration. The simplest tests are those based on the properties possessed by standard oils. Among these is first the specific gravity, which may vary but slightly with narrow limits.

Then again the lower the boiling-point as compared with the true, the more does this point to sophistication with terpenes.

Other fixed standards are the solubility within certain limits, and which is based upon the use of alcohols of 13, 23 and 33 degrees above proof. Usually a definite volume of oil will dissolve in a definite volume of the alcohols of the strengths noted. In certain cases, the solution will be cloudy if the oil contains any waxy or resinous impurities. The relations between the volumes of oil and alcohols will be seen from the following table. It is necessary also to test the residue, consisting of wax, from oils from the citrus fruits; and of anise, fennel and rose oils, the solidifying-point must be determined. The test for the presence of alcohol, which is frequently used for "cutting" or diluting the oil, usually consists in shaking the oil with water in a graduated measuring cylinder, when the increase in the volume of the aqueous layer shows how much alcohol was present. The presence of turpentine oil, which is frequently used, is determined by fractionating a small sample of the volatile oil; if 10% of the first run of the distillate shows a decided change in the angle of rotation towards the left, the possibility of its presence is excluded.

Excellent methods of valuation are also based on the determination of the refractive index in the polarizer, as all the known oils possess average refractive indices characteristic of them. As these methods are, however, at times inconvenient, they will not be gone into.

4. TABLE OF PHYSICAL STANDARDS OF VOLATILE OILS

Volatile oil.	% yield.	% Content of		Times the strength of terpeneless oils.	Specific gravity limits.	Solubility in alcohol.		Remarks.
		Terpeneless oils.	Terpenes, etc.			In volumes.	Degrees overproof.	
Allspice	5	65	35	1½	1 024–1.060	1–2	13	...
Angelica Root	0.4	5	95	20	0.853–0 918	3–5	33	...
Anise	3	65	35	1½	0.980–0.990	2–5	33	Solidifying-point 70° F.
Balm Mint	0.75	65	35	1½	0.890–0 960	2–3	23	...
Bergamot	2	40	60	2½	0.881–0 886	½ and over	33	Residue 4.5%; 35–40% Ester.
Bitter Almond	0.5	...	...	...	1 045–1 070	...	...	...
Bitter Almond without HCN	...	...	...	...	1.050–1 055	...	...	...
Calamus	1 8	15	85	3½	0.960–0.975	½ and over	33	...
Caraway	6	40	60	2½	0 907–0.915	3–10	23	...
Cardamom, total fruits	...	...	...	...	0 895–0.905	...	...	...
Cardamom, from seeds	0 4	50	50	2	0 933–0.940	2–3	13	...
Celery Seed	1	14	86	7½	0.881	2–3	23	...
Cinnamon, Cassia	1 75	65	35	1½	1.055–1 070	2–3	13	Residue 7–8%; Aldehyde 75%;
Cinnamon, Ceylon	0 75	70	30	1½	1.023–1 040	2–3	13	Residue 75%; Aldehyde 65.
Clove	7 5	70	30	1½	1.044–1 070	1–2	13	Eugenol 75–90%.
Coriander	1	65	35	1½	0.870–0 885	2–3	13	...
Dill Seed	2 5	40	60	2½	0.892	3–10	23	...
Fennel Seed	4 5	40	60	2½	0 965–0 975	6–8	23	Solidifying-point 39° F.
Ginger	1 7	10	90	10	0.875–0 888	2–7	38	...
Juniper	1 2	4	96	25	0 860–0.882	5–10	33	...
Lavender	0 65	40	60	2½	0 876–0 880	1–2	33	35–40% Ester.
Lemon	1 5	3 5	96 5	30	0.857–0 861	...	...	Residue 2.5–3%.
Limes	0 4	10	90	10	0 840–0.870	...	...	Residue 3–5%.
Mace	2 5	40	60	2½	0.890–0 939	3 and over	33	...
Marjoram	0 4	35	65	3	0.890–0 910	1–2	23	...
Neroli	0 4	40	60	2½	0 870–0.880	1–2	23	...
Nutmeg	2	40	60	2½	0.895–0 925	3 and over	33	...
Orange, bitter	1 5	1 6	98 4	60	0 854–0.857	...	...	Residue 3–5%.
Orange, sweet	1 5	1.6	98 4	60	0.848–0 853	...	...	Residue 2–4%.
Parsley	1 5	50	50	2	1 050–1.101	5–6	23	...
Petitgrain	0.4	65	35	1½	...	4–5	23	...
Peppermint, American	0 75	70	30	1½	0.900–0.920	3–5	13	Total Menthol 48–60%.
Peppermint, Mitcham	0.75	70	30	1½	0.900–0.910	2–4	13	Total Menthol 51–66%.
Rose	0 006	65	35	1½	0.855–0.870	...	...	Solidifying-point 74–83° F. Geraniol 66–74%.
Rosemary	1	10	90	10	0.900–0.920	1–2	33	...
Sage	1.3	35	65	3	0.860–0.920	2–3	23	...
Star Anise	2 5	65	35	1½	0.982	1½–5	33	...
Tangerine	0.4	1.6	98.4	60	0.854–0.859	...	...	Residue 2.5–3%.
Thyme	1	22	78	4½	...	2–3	13	...
Wormseed	1.2	50	50	2	...	5–6	13	...
Wormwood	0.6	40	60	2½	0.901–0.955	1–2	23	...
Anethol	2	...	...	...	0.984–0.986	1–2 & over	33	Solidifying-point 69–71° F.
Carvone	2.4	...	...	...	0.960–0.966	16–20	proof spirit	=2 vol. 13° proof.
Eugenol	5	...	...	...	1.071–1.074	2–3		

5. Table of Solubility of Volatile Oils in Alcohols of Various Degrees

Volatile oil.	One lb. dissolves in		10 gallons alcohol of degrees underproof dissolve				
	Proof spirit.	7° underproof.	17°	22°	27°	32°	37°
Allspice	½ oz.	12 dr.	12 dr.	7 dr.	6 dr.	4 dr.	3 dr.
Angelica	1 "	4½ "	5 oz.	3¼ oz.	2¾ oz.	2¼ oz.	1¼ oz.
Anise	3 dr.	3/16 dr.	6 dr.	4 dr.	2¾ dr.	2¼ dr.	1¼ dr.
Balm Mint	4 "	⅛ "	14 "	10 "	7 "	5 "	3 "
Bergamot	10 "	⅞ "	2¾ oz.	1¾ oz.	10 "	6 "	3¾ "
Calamus	1 oz.	1¾ "	5 "	3¼ "	2⅜ oz.	1½ oz.	14 "
Caraway	......	1¾ oz.	1¾ lb.	14 "	10 "	8 "	4 oz.
Cardamom	1¼ oz.	2¼ dr.	2¼ oz.	14 dr.	12 dr.	10 dr.	6 dr.
Celery	2 dr.	¾ "	1⅞ "	8½ "	4 "	2 "	¾ "
Cinnamon, Cassia	6 "	1½ "	7½ oz.	5 oz.	1½ oz.	9 "	5 "
Cinnamon, Ceylon	12 "	⅝ "	2¾ "	1⅛ "	12 dr.	7 "	4 "
Cloves	.....	3 "	2⅜ "	10 dr.	7 "	6 "	3¾ "
Coriander	.....	3 "	2½ oz.	2 oz.	14 "	12 "	10 "
Dill	.....	6 "	12 dr.	10 dr.	8 "	4 "	2 "
Fennel	3 dr.	¾ dr.	10 "	6 "	5 "	4 "	3 "
Ginger	12 "	1¼ "	5 oz.	2 oz.	1⅛ oz.	12 dr.	10 "
Juniper	...	18 dr.	8 "	7½ "	6 "	4 oz.	3 oz.
Lavender	.....	6 "	6 "	4 "	2¾ "	2¼ "	1¾ "
Lemon	......	......	3 lb.	1¾ lb.	1¼ lb.	15 "	10 "
Limes	.....	....	5 oz.	3½ oz.	2 oz.	1½ "	1 "
Mace	9 dr.	1¾ dr.	2¾ "	1½ "	1½ "	14 dr.	10 dr.
Marjoram	½ oz.	¾ "	1½ "	12 dr.	10 dr.	7 "	5 "
Neroli	1⅛ "	1½ "	4 "	2¾ oz.	1½ oz.	12 "	8 "
Nutmeg	9 dr.	1¾ "	2¾ "	2¼ "	1½ "	14 "	10 "
Orange, bitter	....	9 oz.	3½ lb.	1¾ lb.	15 "	8½ oz.	6 oz.
Orange, sweet	......	1 lb.	3½ "	1¾ "	1½ lb.	1¼ lb.	1 lb.
Parsley	½ oz.	1¼ dr.	5 oz.	2 oz.	14 dr.	10 dr.	6 dr.
Petitgrain	2 dr.	¾ "	1⅞ "	8½ dr.	4 "	2 "	¾ "
Peppermint, American	4 "	⅛ "	1½ "	12 "	7 "	5½ "	3¾ "
Peppermint, Mitcham	2½ oz.	1½ "	2⅜ "	14 "	11 "	7 "	4 "
Rose	⅛ dr.	1/32 "	8 dr.	7 "	5½ "	3¾ "	2 "
Rosemary	......	6 "	6 "	4 "	2¾ "	2¼ "	1¾ "
Sage	......	3 "	3½ oz.	2⅜ oz.	2 oz.	14 "	8 "
Star Anise	3 dr.	3/16 "	6 dr.	4 dr.	2¾ dr.	2¼ "	1¾ "
Tangerine	......	1 oz.	1½ lb.	1 lb.	15 oz.	12½ oz.	10 oz.
Thyme	......	2 dr.	4 oz.	2 oz.	1 "	11 dr.	7 dr.
Wormwood	12 dr.	¾ "	2 "	1 "	10 dr.	7 "	6 "
Anethol	2 dr.	⅛ "	3¾ dr.	2½ dr.	2¼ "	1½ "	1¼ "
Carvone	3 oz.	10 "	12 oz.	6 oz.	4 oz.	3¼ oz.	2 oz.
Eugenol	5 "	3 "	1½ "	6 dr.	5 dr.	3¾ dr.	2½ dr.

6. Determining the Quality of Volatile Oils

From Table 5 may be ascertained how much of a volatile oil is completely soluble in a given volume of alcohol of varying strength. Solution is best effected in strong alcohol, and declines quite rapidly with the decrease in strength of the alcohol. The solubility of the flavoring constituent is limited to a certain extent,

which is defined in the table for alcohol of various strengths, and which shows how much oil will dissolve in 1 lb. alcohol of 7° overproof as well as proof strength, these data being of value for the manufacture of concentrated solutions in essence manufacture, while the extensions carried out for 10 gallons of alcohol of different strengths gives the greatest quantities of oil which can be dissolved.

The quality of the volatile oils is ascertained from the ester content and the particular alcohol resulting, which are fully detailed under the heading Alkalimetry, in Part III.

The aldehydes are quantitatively determined by shaking out with a sodium bisulphite solution in which they dissolve. The volume of the insoluble residue is read off by means of a scale, and the reduced volume deducted from that originally taken. The solution is effected in a 30% sodium bisulphate solution in a water-bath, and affords good results with cinnamon oils, although the results with lemon oil are not quite satisfactory.

The phenol determination is also effected mechanically, by effecting solution in a 3 to 5% sodium hydroxide solution. The residual oil separates and floats on the surface of the mixture, and may be read off on a scale and the proper calculation made accordingly.

7. Terpeneless Oils

As the name designates, these are volatile oils from which the terpenes have been removed, with, at the same time, some other constituents which cause cloudiness when dissolved in alcohol.

The terpeneless oils are characterized by a high degree of solubility in diluted alcohol.

(a) *Vacuum Method*

The process is based on a fractional distillation which is carried out in a vacuum in order to reduce the boiling-point. By careful regulation, all the terpenes pass over first, followed by the sesquiterpenes, in the first run. The true flavoring constituent distils over at a rather constant boiling-point as a terpeneless oil, while the higher-boiling fractions remain in the still or pass over in the final distillate. Despite its exactitude, however, this method has the disadvantage that the boiling-point, in spite of the vacuum, is relatively high, whereby some of the finer flavoring portions are lost.

(*b*) *Alcoholic Distillation*

This method deserves preference because the average boiling-point is below that of water. The operation is carried out in an ordinary rectifying still, and is based upon the ability of alcohol vapors to carry along with them the undecomposed volatile oils. The medium used is an alcohol of 17° underproof which, when distilled, affords an alcohol of about 30° overproof in the early stages of distillation. For distilling, 1 part of the volatile oil is mixed with at least 5 parts of the 17° underproof alcohol. The distillate is collected in a Florence flask, the alcoholic portion being returned to the still by a return pipe, so that the working strength of the alcohol in the still as well as the alcoholic vapors always remains constant. The oil passes over with the alcohol vapors, but during condensation the terpene separates as it is not soluble in alcohol of the strength present, while on the other hand the flavoring constituent is quite easily soluble. The oily solution consequently is always being returned to the still while the terpene collects on the surface of the distillate as a colorless liquid. During this continuous procedure, more and more terpene is separated and the layer increases in volume, so that it is only necessary to continue the distillation until the volume of the layer ceases to increase. At first this operation proceeds quite rapidly but gradually it slackens as the terpene content of the still decreases. By measuring the terpene and comparing with the terpene number of the oil it is easy to determine about when the distillation is at an end. The collected terpene, when dried, constitutes a special article of commerce. The alcoholic residue in the flask is returned to the still, and, with the addition of a suitable quantity of water, distilled, but the return tube is now connected with a cooled receiver instead of the flask. At first alcohol vapors, saturated with the flavoring, distil over, but with the decrease of alcohol strength, the terpeneless oil separates in the flask in the form of a yellow layer. It will be found that the greater portion of the terpeneless oil will have been obtained when the distillate contains no more alcohol. The distillate, however, contains some terpeneless oil in solution, and to obtain this oil, the distillate is diluted to an alcohol strength of 47° underproof, when it separates, and is then added to the main portion. The weak alcohol thus resulting is now rectified, and as it still possesses

a decided odor, it is used for a new manipulation, or for the manufacture of a suitable essence.

The terpeneless oil must always be dried by shaking with anhydrous sodium sulphate, and preserved in dark bottles, and protected from light and air. For general use it is best to keep the oil mixed with an equal volume of absolute alcohol. The following table gives the solubility of the terpeneless oils in alcohols of various strength.

(*c*) Table of Solubility of Terpeneless Oils in Alcohol of Various Strength

Terpeneless oils.	One lb. dissolves in		10 gallons of degrees underproof alcohol dissolve				
	Proof spirit.	7° underproof.	17°	22°	27°	32°	37°
Allspice	5 dr.	½ dr.	8½ dr.	5 dr.	4 dr.	2½ dr.	2 dr.
Angelica	¾ "	¼ "	3½ "	2½ "	2 "	1¾ "	1 "
Anise	2 "	¼ "	3½ "	2½ "	2¾ "	1¾ "	1¼ "
Balm Mint	2½ "	1½ "	10 "	7 "	5 "	3½ "	2½ "
Bergamot	2 oz.	2½ "	1⅛ oz.	11 "	4 "	2½ "	1½ "
Calamus	4½ dr.	½ "	11 dr.	7 "	5 "	3 "	2 "
Caraway	3¼ oz.	11 "	12 oz.	6 oz.	4 oz.	3¼ oz.	2 oz.
Cardamom	7 dr.	1¼ "	1 "	7 dr.	2½ dr.	½ dr.	¼ dr.
Celery	2¼ "	1¼ "	2⅜ "	12 "	5 "	2½ "	1 "
Cinnamon, Cassia	4 "	1¼ "	5 "	3¼ oz.	1 oz.	6 "	5 "
Cinnamon, Ceylon	7 "	2¼ "	2 "	12 dr.	8½ dr.	5 "	3 "
Cloves	5 oz.	1¾ oz.	1½ "	6 "	5 "	3¾ "	2½ "
Coriander	2⅜ "	1¾ "	1½ "	1¼ oz.	11 "	8½ "	6 "
Fennel	2 dr.	¼ dr.	3¾ dr.	2½ dr.	2 "	1¾ "	1 "
Ginger	1¼ "	⅜ "	5 "	4½ "	1¾ "	1½ "	1 "
Juniper	2½ "	½ "	5 "	4½ "	3¾ "	3¼ "	2½ "
Lavender	8½ "	¾ "	1⅛ oz.	10 "	6 "	5 "	3¾ "
Lemon	1½ "	2¼ "	1½ "	14 "	11 "	7 "	5 "
Mace	1¼ "	¼ "	6 dr.	5 "	3¾ "	2¼ "	1½ "
Marjoram	2¼ "	¼ "	8½ "	4¼ "	2½ "	2¼ "	1½ "
Neroli	6 "	½ "	2 oz.	1 oz.	8½ "	6 "	3¾ "
Orange, bitter	1¼ oz.	1¾ "	14 dr.	7 dr.	3¼ "	2½ "	1½ "
Orange, sweet	1¼ "	1¼ "	14 "	7 "	6 "	5 "	3½ "
Parsley	3¾ dr.	¼ "	2 oz.	12 "	7 "	5 "	3 "
Petitgrain	10 "	¾ "	1½ "	7 "	6 "	3½ "	2½ "
Peppermint, American	1½ oz.	2 "	1 "	8 "	5 "	3¼ "	2½ "
Peppermint, Mitcham	2 "	2½ "	1½ "	10 "	7 "	5 "	3 "
Rose	½ dr.	1/16 "	2½ dr.	½ "	⅜ "	¼ "	3/16 "
Rosemary	2¾ "	4½ "	3¼ oz.	1½ oz.	10 "	6 "	4 "
Sage	12 "	½ "	1⅛ "	12 dr.	10 "	5 "	3 "
Star Anise	2 "	¼ "	3⅜ dr.	2½ "	2 "	1¾ "	1 "
Tangerine	6 "	¼ "	6 "	5 "	3½ "	3¼ "	2½ "
Thyme	1¼ oz.	½ "	12 "	7 "	4 "	3¾ "	2½ "
Wormwood	3¾ dr.	¼ "	12 "	7 "	3¾ "	3 "	2½ "

D. Chemicals

1. Inorganic Chemicals for the Mineral Water Industry

Of the innumerable compounds of inorganic chemistry, and which are articles of commerce, only the most important of those used in the mineral water industry will require discussion. The composition of these salts will be given in the following table, their purity requirements will be given under the analytical methods in Part III.

(*a*) *Haloid Salts* (*Bromides, Chlorides and Iodides*).

These are generally to be examined for sulphur, carbon dioxide and metal salts, particularly iron salts. The alkali salts, moreover, are to be examined for calcium and magnesium; and the calcium chloride for magnesium.

		Soluble in water
Bromide of	Ammonium, NH_4Br	easily
"	" Potassium, KBr	"
"	" Sodium, NaBr	"
Chloride of	Aluminum, $AlCl_3 + 6\ H_2O$	"
"	" Ammonium, NH_4Cl	1 : 4
"	" Barium, $BaCl_2 + 2\ H_2O$ (poisonous)	1 : 3
"	" Calcium, $CaCl_2 + 6\ H_2O$	easily
"	" Potassium, KCl	1 : 3
"	" Lithium, LiCl	1 : 5
"	" Magnesium, $MgCl_2 + 6\ H_2O$	easily
"	" Sodium, NaCl	1 : 2.5
"	" Strontium, $SrCl_2 + 2\ H_2O$	1 : 3
Iodide of	Sodium, NaI	easily

(*b*) *Sulphates.*

These are to be tested generally for hydrochloric and carbonic acids, metal salts (excepting those of copper and manganese) and particularly for iron. The alkali sulphates are also to be tested for calcium and magnesium.

		Soluble in water
Sulphate of	Aluminum, $Al_2(SO_4)_3 + 18\ H_2O$	1 : 10
"	" Copper, $CuSO_4 + 5\ H_2O$ (poisonous)	1 : 2.5
"	" Iron (ous), $FeSO_4 + 7\ H_2O$	1 : 2
"	" Potassium, K_2SO_4	easily
"	" Manganese, $MnSO_4 + 5\ H_2O$	1 : 2.5
"	" Magnesium, $MgSO_4 + 7\ H_2O$	1 : 1.5
"	" Sodium, $Na_2SO_4 + 10\ H_2O$	1 : 2.5

(c) *Carbonates.*

These, so far as the soluble salts are concerned, are to be examined for sulphuric and hydrochloric acids, and for metal salts, particularly iron.

	Soluble in water
Carbonate of Calcium, $CaCO_3$	insoluble
" " Potassium, K_2CO_3	easily
" " Lithium, Li_2CO_3	1 : 80
" " Magnesium, $MgCO_3$	insoluble
" " Sodium, $Na_2CO_3 + 10\ H_2O$, crystals	easily
" " " $Na_2CO_3 + 2\ H_2O$, dried	1 : 2
Bicarbonate of Sodium, $NaHCO_3$	1 : 12

(d) *Various Inorganic Salts.*

These are to be examined for hydrochloric, carbonic and sulphuric acids, and for metal salts, particularly iron.

	Soluble in water
Sodium Arsenate, Na_3AsO_4 (poisonous)	easily
" Biborate (Borax), $Na_2B_4O7 + 10\ H_2O$	1 : 17
" Nitrate, $NaNO_3$	easily
" Phosphate, $Na_2HPO_4 + 12\ H_2O$	1 : 1.5
" Silicate, Na_3SiO_4	easily in hot water
" Sulphide, Na_2S	easily

(e) *Free Acids.*

Arsenous Acid (White Arsenic), As_2O_3 (poisonous).
Phosphoric Acid, 75%, sp. gr. 1.500
" " 25%, " " 1.154
Sulphuric Acid, 98.5%, " " 1.836–1.840

2. Alcohols and Their Corresponding Derivatives

(*Aldehydes, Acids and Esters*)

(a) *General Considerations.*

The alcohols correspond to the bases in inorganic compounds, and, like these, are hydroxyl (OH) compounds, *e.g.*, methyl alcohol, $CH_3(OH)$. Now each base corresponds to an oxide, and the oxides are designated as esters, or ethers, of which the one most interesting to us is ethylic ether (sulphuric ether). The alcohol may be oxidized, and then yield as intermediate products first aldehydes, distinguished by the radical (COH). The final oxidation products are acids, having the general radical (COOH).

The most important alcohols of the so-called fatty series are products, or by-products, of the fermentation of sugar and the

substances accompanying it, with the exception of methyl alcohol, which is obtained by the destructive distillation of wood. The higher homologues of the alcohols are constituents of plant fats. Besides the alcohols of the fatty series there are various other groups, as, for instance, the raw products for making benzoic and salicylic acids.

All alcohols are distillable. Those having low boiling-points are fluid; those with higher boiling-points are solid. They are all acted on by oxidizers, and, in fact, for the low-boiling alcohols, as, for instance, ethyl alcohol, the contact with air suffices, in the presence of bacteria, to convert them into acetic acid. The higher-boiling alcohols, on the other hand, have to be acted on by oxidizers, such as chromium trioxide.

The acids, again, give rise to characteristic salts, which are obtained as definite products by the action of the acids on the alcohols which serve as bases, sulphuric acid being used as a catalytic. The various kinds of products so obtained differ by reason of a constant boiling-point, which increases with increase in the number of carbon atoms. The boiling-point is relatively low among the aldehydes, and rises among the acids and esters.

The esters form not only the basis of the so-called fruit ethers, but they are also employed technically, as for cleansing preparations and in varnishes. The higher ethers, particularly those of the fusel-oil group, such as propyl, butyl and amyl ethers, are obtained by the fractional distillation of products obtained from crude fusel oil, and resulting as a by-product in the manufacture of alcohol and its rectification, this by-product being a mixture of propyl, butyl and amyl alcohols and their isomers, which distil over after the ethyl alcohol.

The following Table I shows the composition of the alcohols and their corresponding acids and aldehydes, with their boiling-points and coefficients, the latter being identical with their molecular weights. Table II shows the composition of the raw fusel oil, and the manufacture of the raw materials for making amyl ester.

TABLE 1. ALCOHOLS, ALDEHYDES AND CORRESPONDING ACIDS

Alcohols, name.	Boiling-point, F.	Coefficient.*	*Aldehydes,* name.	Boiling-point, F.	Coefficient.	*Acids,* name.	Boiling-point, F.	Coefficient.	Specific gravity.
Methyl Alcohol	152°	32	Formaldehyde	...	44	Formic Acid	194°	46	....
Ethyl "	172°	46	Acetaldehyde..	70°	58	Acetic "	244°	60	1.050
Isopropyl "	179°	60	....	..	...	....	...	....	....
Propyl " Normal	207°	60	Propylaldehyde	120°	72	Propionic Acid	286°	74	0.902
Butylalcohol ..	..	74	Butylaldehyde	146°	88	Butyric "	311°	88	0.940
Primary......	210°	..	....	....	...	....	.....	..	....
Normal.....	243°	..	....	....	....	....	.....	....	....
Iso-	225°	...	....	..	..	....	..	...	....
Amyl Alcohol..	270°	88	Valeraldehyde	209°	100	Valeric Acid (Iso-)	345°	102	0.947
Hexyl "	....	102	....	.....	...	Caproic "	401°	116	0.945
Heptyl "	...	116	....	.....	....	Œnanthic "	433°	130	....
Octyl "	...	130	....	......	....	Caprylic "	459°	144	....
Decyl "	....	158	....	....	.	Capric "	......	172	....
" "	...	...	....	..	..	†Sebacic "	...	202	....

Aromatic Acids

Benzylalcohol .	403°	108	Benzaldehyde	356°	...	Benzoic Acid	......	122	....
"	....	....	....	......	...	Salicylic "	......	138	....
"	.....	..	....	.....	.	†Succinic "	.....	118	....

* The coefficients are identical with the molecular weights of the products.

† Diabasic acids.

This table gives only the most important products constituting the raw materials for the ester manufacture.

TABLE 2. FRACTIONATION PRODUCTS OF RAW FUSEL OIL, AND MANUFACTURE OF RAW MATERIALS FOR THE ETHER, OR ESTER, MANUFACTURE

The raw fusel oil is calculated on the basis of an extraction made by shaking out with a saturated solution of sodium chloride, and which should not extract over 10%.

There are three general fractions, the so-called light oils, soluble in water; a hydrous middle run, the "wet" oils (containing some water); and the higher-boiling anhydrous, or water free fraction.

The run of the fractions is as follows:

		Boiling-point F.:		
About 25% so-called light fusel oil	Methyl alcohol	153°–167°	abt. 2%	= about 6% lightest fractions.
	Ethyl alcohol	167°–180°	" 4%	
	Secondary Propyl alcohol	180°–190°	" 8%	= about 19% technical *Propyl alcohol.*
	Normal Propyl alcohol	190°–206°	" 8%	
	Primary Butyl alcohol	206°–212°	" 3%	
20% "Wet"	Fusel oil	212°–233°	abt. 20%	After dehydrating, is worked up as below.*
51% water-free fraction	Normal Butyl alcohol	233°–260°	abt. 6%	*Butyl alcohol.*
	Amyl alcohol	260°–270°	" 45%	as *C. P. Amyl alcohol.*
4%	Residue	......	" 4%	brown and resinous.
			100%	

* The *hydrous fraction* contains about 10% of water, which is removed by exsiccated potassium carbonate, then rectified once more with the following result:

Loss of water by drying about 10%

	Boiling-point F.			
Normal Propyl alcohol	185°–208°	about 15%	To the above technical Propyl alcohol.	
Primary Butyl "	208°–218°	" 25%		
Isobutyl alcohol	218°–227°	" 20%	Isobutyl alcohol	55% technical Butyl alcohol.
Normal Butyl alcohol	227°–260°	" 30%		

(*b*) *The Alcohols*

Methyl alcohol, or wood spirit, or wood alcohol, results, together with pyroligneous acid and acetone, during the destructive distillation of wood. The distillate is first neutralized with lime, and the crude product is utilized for the manufacture of acetic acid. To the residual lye calcium chloride 's added, which combines with the methyl alcohol, and permits the distilling off of the other volatile products (*e.g.*, acetone). The residue is then treated with water, by which the methyl alcohol is liberated and then obtained by distillation. Methyl alcohol is poisonous, and hence cannot be used as a substitute for ethyl alcohol, but it may be used technically as a solvent. *Ethyl alcohol* is the product of the fermentation of invert sugar, and is obtained from the mash by distillation

and rectification in the usual manner. Starchy products, *e.g.*, potatoes and maize, are converted into fermentible sugars, for industrial alcohol, and corn for refined alcohol. Even cellulose may be similarly converted into sugar, and the latter into alcohol. Ethyl alcohol forms the raw product for the manufacture of alcoholic beverages.

Propyl and Butyl alcohols are found as various isomers in raw fusel oil, and are obtained by special methods from the fermentation products of wine yeast and wine residues.

Amyl alcohol is the chief constituent of raw fusel oil.

Higher alcohols are often constituents of some volatile oils, and particularly as glycerides in fats. Of the aromatic alcohols, the only one of interest to us is benzyl alcohol, which is an oxidation product of toluene.

(*c*) *Aldehydes*

These are intermediate oxidation products of alcohols. They are very easily oxidized, and hence constitute powerful reducing agents.

Formaldehyde (obtained from methyl alcohol) occurs as a gas, but is marketed as a 35% aqueous solution under the name "formaldehyde," or "formalin," and it is used as a disinfectant.

Benzaldehyde is the chief constituent of bitter almond oil, and is developed in the kernels of stone fruits by the interaction of the glucoside amygdalin and the ferment emulsin, together with hydrocyanic acid as a by-product. Synthetically it is prepared from benzyl chloride.

(*d*) *Organic Acids*

Formic acid is obtained by the decomposition of oxalic acid, which may be considered as a compound of carbonic acid and formic acid. The decomposition is effected by distilling with glycerin which, during the decomposition, is always regenerated. Formic acid is used as a disinfectant and preservative, and is marketed in 25% and 75% solutions.

Acetic acid is the oxidation product of dilute alcoholic liquids, and results from the action of the acetic-acid bacteria with sufficient access of air, as fermentation vinegar; it is the cause of the souring of beer and wine. Acetic acid itself is obtained by the decomposition of crude calcium acetate obtained as a by-product in the destructive distillation of wood. The crude acid is purified by repeated rectification, and when diluted serves as table vinegar.

Butyric acid is a fermentation product obtained by the action of the lactic-acid bacillus. To obtain it, sugar, starch, dextrin, etc., are fermented with putrid cheese at 86 to 100° F., the acid formed being then neutralized with chalk. Calcium lactate is first formed, from which lactic acid may be obtained. In the course of time, however, the calcium lactate is converted into calcium butyrate, and from this the butyric acid is isolated by the action of sulphuric acid.

Valeric acid is the oxidation product of amyl alcohol, from which it is obtained by oxidizing the alcohol with chromium trioxide. This is effected by adding a solution of potassium dichromate with sulphuric acid at a temperature not exceeding 155° F. The crude valeric acid is neutralized with sodium hydroxide, and the undecomposed fusel oil, as well as any valeraldehyde formed, distilled off. The residue is treated with sulphuric acid, and the pure valeric acid distilled off. It serves for the manufacture of valeric ether.

Capric, Caproic and Caprylic acids are fatty acids of unpleasant odor, and are particularly found in perspiration. Caproic acid results during the fermentation of wheat bran; capric acid from oil of rue; and caprylic acid by the oxidation of soaps with steam under pressure. *Œnanthic acid* is a fermentation product of wine yeast, but is obtained by distilling castor oil with steam under pressure. *Sebacic acid* results on distilling oil soaps with steam under pressure.

All these minor acids are employed to make the corresponding esters which are very similar to the fermentation products, particularly of wine, and to which the "bouquet" is due.

Of the aromatic acids only the following are used in the ester industry:

Salicylic acid is obtained by the action of carbon dioxide on a phenol-sodium solution, the resulting sodium salicylate being then decomposed by acids.

Benzoic acid is found naturally in benzoin resin, and is obtained from this by sublimation. The synthetic acid, on the other hand, is an oxidation product of benzyl alcohol. Both the natural and synthetic acids are powerful preservatives.

Succinic acid is usually obtained by the dry distillation of amber, or synthetically by fermenting calcium malate with cheese at 86 to 100° F.

(e) *Esters*

These result, as is well known, from the action of organic acids on alcohols, and they differ from each other particularly as to their boiling-points, the latter rising with the increase in number of the carbon atoms, as will be seen from the following table:

TABLE OF THE MOST IMPORTANT ESTERS

Coefficient = the molecular weights.

Methyl Esters

	Boiling-point, F.	Coefficient.		Boiling-point, F.	Coeffi-cient.
Formate	136°	60	Benzoate	374°	136
Acetate	147°	74	(Niobe oil)		
Propionate	176°	8	Salicylate	415°	152
Butyrate	205°	102	(Artif. wintergreen		
Valerate	312°	116	oil; spec. gr. 1.032)		

Ethyl Esters

	Boiling-point, F.	Coeffi-cient.	Spec. gravity.		Boiling-point, F.	Coeffi-cient.
Formate	130°	74	0 750	Caprylate	405°	172
(*Formic Ether*)		88	0 800	Caprate	469°	200
Acetate	190°	102	0 830	Benzoate	435°	150
(*Acetic Ether*)		116	0 900	(*Benzoic Ether*)		
Propionate	210°	130	0 886	Salicylate	473°	166
Butyrate	210°	158	......	(*Salicylic Ether*)		138
(*Butyric Ether*)		158	......	Sebacate	608°	87
Valerate	271°	......	......	(*Sebacic Ether*)		......
(*Valeric Ether*)		......	......	Succinate	536°	......
Caproate	330°	......	......	(*Succinic Ether*)		......
Œnanthate	368°	......	......	......	......	......

Propyl Esters

	Boiling-point, F.	Coefficient.		Boiling-point, F.	Coeffi-cient.
Acetate	204°	102	Butyrate	262°	130
Propionate	234°	116	Valerate	311°	144

Butyl Esters

Formate	208°	102	Butyrate	312°	144
Acetate	248°	116	Valerate	352°	158
Propionate	266°	130	Isobutyl Acetate	234°	116

Amyl Esters

Formate	257°	116	Valerate	370°	172
Acetate	293°	130	Caprate	554°	242
Butyrate	312°	158	(Artif. wine fusel oil)	....	......
Benzyl Acetate	403°	151	Benzoate	527°	192
Benzyl Benzoate	661°	212			

CHEMICAL REACTION SHOWING THE FORMATION OF ESTERS IN GENERAL

Example: Acetic Ether.

$C_2H_5(HO)$	+	$CH_3 \cdot COOH$	=	$CH_3COO \cdot C_2H_5$	+	H_2O
Ethyl Alcohol		Acetic Acid		Ethyl Acetate (Acetic Ether)		Water
Mol. wt. 46.		Mol. wt. 60.		Mol. wt. 88.		Mol. wt. 18.

Result.

46 parts ethyl alcohol 100%, calculated, and 60 parts acetic acid 100% are necessary to obtain theoretically 88 parts acetic ether, and 18 parts of water as by-product.

For purposes of calculation set down the molecular weights of the alcohols and acids to be used as materials for the ester manufacture as in the reaction just shown, in order to obtain the theoretical yield as shown by the molecular weights of the resulting esters.

The manufacture proceeds as follows: Sulphuric acid is added, not because it takes direct part in the ester formation, but as a catalytic. The specific acid to be used and the alcohol are introduced into the apparatus and heated to boiling, because the esterification proceeds only at the boiling-point. In order that this shall be thorough, the boiling is carried on for some time, using a reflux condenser, whereby the presence of too much undecomposed acid or alcohol will be avoided in the distillate. The product is then distilled and washed in washing cylinders containing an alkali to neutralize the acid. When water-soluble alcohols, like ethyl alcohol, are used, the undecomposed portions are taken up by the wash-liquid, and recovered later by distillation. As the raw ester contains some water, it is dried over calcium chloride, and then rectified. In the case of a high-boiling ester which cannot be distilled over, even by increasing the steam pressure to 5 atmospheres, use is made of the vacuum. In any case not all the fractions are pure; the ester contains some moist portions which pass over in the first part of the distillate, or, when high-boiling alcohols have been used, it will contain some undecomposed portions of these, which must be removed by fractionation. The standard for a pure ester is based upon the ester being absolutely free from water and alcohol, and from other alcohols. It is a requisite that a sample should afford a clear mixture, free from turbidity, with benzene, and, in critical cases, with liquid paraffin.

The commercial esters are not always pure, due partly to their mode of manufacture and partly to insufficient rectification. Sometimes, however, the esters are purposely "cut." Then their alcohol and water content is ascertained by shaking out with a saturated sodium chloride solution, the volume of which will not be increased if the ester is pure, with the slight exceptions mentioned under formic and acetic ethers. The determination is more accurately made by saponification, a sample of the ester being boiled under a reflux condenser with a normal alkali solution, whereby an equivalent quantity of the acid is converted into an alkali salt; the residual normal alkali is then titrated.

Formic ether (ethyl formate) when shaken out with sodium chloride solution shows an effective content of only up to 84% ester.

Acetic ether (ethyl acetate) is marketed in various grades, prepared by diluting the purer kinds with alcohol and water. The following values for the several grades are obtained on shaking out:

Acetic ether,	C.P., sp. gr. 0.905	97%
" "	(Pharm. Germ. V) sp. gr. 0.900–0.904 (98% pure ether and 2% alcohol)	96%
" "	Absolute, sp. gr. 0.875 (70% pure ether and 30% alcohol)	68%
" "	Twice-rectified, sp. gr. 0.890 (70% pure ester, 20% alcohol and 10% water)	68%
" "	Rectified, sp. gr. 0.875 (50% pure ether, 35% alcohol and 15% water)	45%

Most of the other esters require no further attention, their most important physical data being given in the tables.

Amyl acetate is obtained in chemically pure form in the usual manner. Large quantities, however, are used in the manufacture of lacquer, particularly zapon lacquer, for which purpose a pure product is not used, but either crude fusel oil or a by-product of its fractionation. The boiling-point of pure amyl acetate is 293°F., and the value of the technical amyl acetate is based upon the fact that a large number of fractions have boiling-points approximating that of the pure acetate, and in fact as a criterion it is required that not more than 5% should boil below 212° F. and at least 50% should boil above 287° F. The following table shows the application of the various sorts of fusel oil, and the figures are based in every instance on the employment of 60 lb. 100% acetic ether

and 8 lb. sulphuric acid for the given quantities of the various fusel oils, to form 130 lb. of ether in each case.

	Fusel oil used	Boiling-point range
90 lb.	C. P. amyl alcohol	287 to 300° F.
110 "	"Wet" Fusel oil	239 " 300° F.
130 "	Light " "	194 " 302° F.
100 "	Fusel oil residue	257 " 311° F.
110 "	Crude Fusel oil	194 " 311° F.

The crude ether obtained is dried as usual with calcium chloride, and when rectified yields at first about 20% distillate containing about 20% water; this distillate is then dried as usual, and again distilled. Of the distillate obtained, the first 5% is already clearly miscible with benzene, while the balance, 75%, is absolutely dry, and is miscible with paraffin oil, and adapted for use in lacquer manufacture.

Addendum. Zapon Lacquer

Zapon lacquer consists of a solution of gun cotton (nitrocellulose) in amyl acetate, diluted with equally volatile substances to a varnish-like consistency. The so-called celluloid paste consists of 40% gun cotton dissolved in 60% amyl acetate, whereby it loses its explosive power. This paste is worked up into a zapon lacquer having the following composition:

Celluloid Paste	20 parts
Amyl Acetate	30 "
Benzin (boiling-point 140 to 167° F.)	40 "
Methyl Alcohol	10 "

This stronger lacquer contains 8% celluloid, and for use is diluted to suitable consistency by means of a diluent made from 35 parts amyl acetate, 50 parts benzin and 15 parts methyl alcohol. Medium lacquer consists of 75% stronger lacquer and 25% diluent, and the so-called dip lacquer, in which the articles to be lacquered are dipped, consists of equal parts stronger lacquer and diluent. Tinted with tar dyes, the lacquers are adapted for coloring electric bulbs for decorative illuminating purposes.

Ethyl ether (*sulphuric ether*) is obtained by the reaction of sulphuric acid on alcohol at a temperature of 290° F. The product is condensed by cooling with ice, and has a specific gravity of 0.720, and boils at 113° F. It is chiefly used technically.

Ethyl nitrite is obtained by distilling nitrous acid with alcohol. It boils at 64° F., and has an odor of apples, for which reason it is employed in making fruit ethers.

3. The So-called Fruit Acids for the Lemonade Industry

All fruits contain malic, citric, or tartaric acid in variable proportions, the acids being obtained from the fruit juices.

Malic acid is found in unripe fruits, such as green grapes, apples, mountain ash berries, etc., and is obtained from the juices of these fruits by precipitating in the form of lead malate by the addition of solution of lead acetate. The malate is then washed, and finally decomposed by hydrogen sulphide gas. The malic acid liberated remains in solution, and is concentrated by evaporation, being thus obtained as easily deliquescent crystals. On account of its costliness, it is scarcely ever used practically, the more particularly as it presents no advantage over citric or tartaric acid.

Citric acid is prepared from the lemon juice obtained as a by-product in the manufacture of lemon oil by expression. The juice of unripe fruits may also be advantageously employed.

The freshly expressed lemon juice is neutralized with lime, and is then heated to boiling, whereupon the calcium citrate is precipitated. This is washed, and decomposed by sulphuric acid. After the resulting calcium sulphate has separated, the regenerated citric acid in the solution is evaporated in lead pans until it crystallizes. For chemically pure qualities stone or porcelain vessels must be used for the evaporation.

Citric acid occurs as crystals which are deliquescent in the air, melt at 345° F. and burn with a pyroligneous odor.

Tartaric acid is obtained from the tartar, consisting of potassium bitartrate, which is deposited in the form of a thick crust on the barrel walls as a result of the fermentation of wine, because it is insoluble in alcoholic liquids. The crude tartar is boiled with hydrochloric acid and water, and the solution is neutralized with milk of lime. The resulting calcium tartrate is then decomposed with sulphuric acid, the further treatment being then the same as for citric acid.

Tartaric acid crystals melt at 338° F., and at a higher temperature burn with a decided odor. It is fully the equal of citric acid in taste.

Lactic acid does not belong to the true fruit acids, but is an oxy-acid. It develops in the souring of milk, caused by certain bacteria, and is manufactured on the large scale by fermenting starch,

sugar, dextrin, etc., with decomposing cheese, and with the addition of chalk in liberal quantities to neutralize the acid as it forms. The calcium lactate so obtained is decomposed by sulphuric acid, and the lactic acid liberated is then concentrated by distillation in a vacuum.

4. Carbohydrates

The members of this class are exceedingly important in the manufacture of foods and beverages. *Sugar* plays a very great rôle in fermentation and as a corrigent or improver of taste. Cane sugar, whether obtained from the sugar cane, or from beets, is not directly fermentable. It is not so frequent in fruits, but is found in the stems (sugar cane), and in the root organs (beets). During its purification there result by-products, such as molasses, which are worked up into alcohol. The purified sugar is employed in comestibles. In the form of solution it is a constituent of our syrups. In crystallized form it constitutes rock candy. By the action of dilute acids it is hydrolyzed, taking up water and being converted into grape (or starch) sugar (dextrose), and fruit sugar (levulose), both of which are fermentible. Starch sugar is chiefly made from potatoes, and in the crude condition contains much dextrin. The starch sugar syrup (glucose) is used as a thickening agent for liqueurs.

The fermentation of sugar is initiated by ferments, alcohol and carbon dioxide being formed. Other carbohydrates, particularly starch, may also be converted into convertible sugars. This is effected by the enzyme diastase, which causes the malting of grain, the malt sugar so formed being fermented to beer or alcohol. Grape sugar is, however, also obtained by the action of dilute acids on starch, and the fermentation of the grape sugar so made forms the basis of the alcohol industry. Even cellulose has recently been worked up as a source of alcohol.

5. Aromatic Products

The group of products derived from the benzene nucleus is uncommonly diverse, and, as the heading intimates, comprises a large number of odorous substances. To these belong the many odor- and taste-bearing constituents of the volatile oils in the form of alcohols, aldehydes and ethers, ketones, etc., as well as the terpenes and a number of odorous artificial products derived

from them, such as ionone, nerolin, yara-yara, etc., so widely used in the essence industry. A large number of the taste carriers of the volatile oils are either synthetically made, or isolated from cheap raw material; and frequently one compound is converted into another; thus the system of artificial odors is constantly branching out. The artificial volatile oils constitute such isolation products, and their disadvantage is due to the absence of certain constituents present in the natural product, which impart the bouquet possessed by the latter. Among other artificial odorous substances may be mentioned vanillin and cumarin. Vanillin is an aldehyde found not only in the vanilla bean, but also in Siam benzoin, and is also made synthetically from eugenol by oxidation. Cumarin, found naturally in tonka bean, woodruff, and fresh hay, may be made artificially by the action of salicylaldehyde on sodium acetate.

The extractives found in the plant kingdom contain many well-formed products having a decided effect on the taste, and which are for the most part bitter. Such are the *alkaloids*, as quinine, although the greater number are cathartic or poisonous in effect, so that they are chiefly used medicinally. The like is the case with the *glucosides*, although the taste of certain aromatic constituents depends upon them. They possess the property of being converted by suitable enzymes into a sugar and another aromatic compound, for instance, amygdalin is converted by the enzyme emulsin into grape sugar and benzaldehyde, the poisonous hydrocyanic acid being at the same time formed. In similar manner mustard oil is formed. Saponin and glycyrrhizin, which are both used as foam producers, are also glucosides.

Lastly we must mention the group of true *bitter* extractives, which are chiefly found in the bitter drugs. Even the vegetable dyes are similar compounds, while the aniline dyes are obtained from coal tar. Furthermore, there are the *albuminoids*, such as albumin, pectin and mucin, and lastly the *enzymes* constituting the active component of the yeasts.

PART III

LABORATORY PRACTICE

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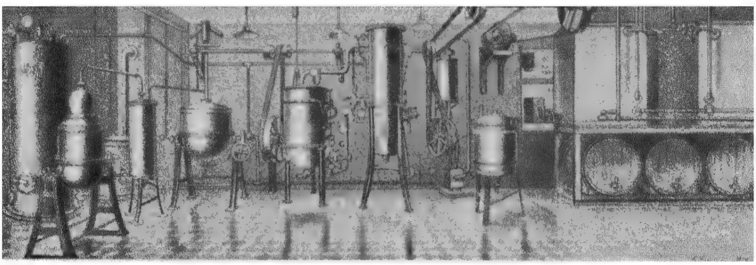
PART III

LABORATORY PRACTICE

A. General Manufacturing Methods

1. Expressing

Among the simplest methods is that of expressing, *i.e.*, the removal by mechanical pressure of any liquid contained in a substance. The most usual is the expression of parts of plants, and



(*a*) (*b*) (*c*) (*d*) (*e*) (*f*) (*g*) (*h*)

Fig. 1. General view of a modern essence manufacturing installation.

(*a*) Steam boiler.
(*b*) Fermentation kettle.
(*c*) Steam kettle.
(*d*) Vacuum apparatus.
(*e*) Receiver and condenser.
(*f*) Air pump.
(*g*) Filter.
(*h*) Storage tanks for syrup, with coolers.

the fruit juice industry is especially concerned with the employment of the press. The simplest forms of the press is the wine press, but in the fruit juice industry better forms are used in order to obtain the highest yield of juice possible. The main requisite in a press is that those parts that come into contact with the liquid should not be made of metal, because the presence of tannin in the plant juices gives rise to a discoloration, while at the same time the taste of the juice may be seriously impaired under certain circumstances. Usually the fruit is placed in a cylindrical receptacle provided with press cloths, and the mass subjected to pressure by means of a stamper fitted to the receptacle. The oldest forms of presses are simply screw presses, but in the modern

presses the differential lever is employed, which, with the application of little force, exert great power. The bent-lever presses act similarly. The ideal presses, however, are the hydraulic presses, which exert a most tremendous power. The results of an expression depend first upon the character of the press, and upon the

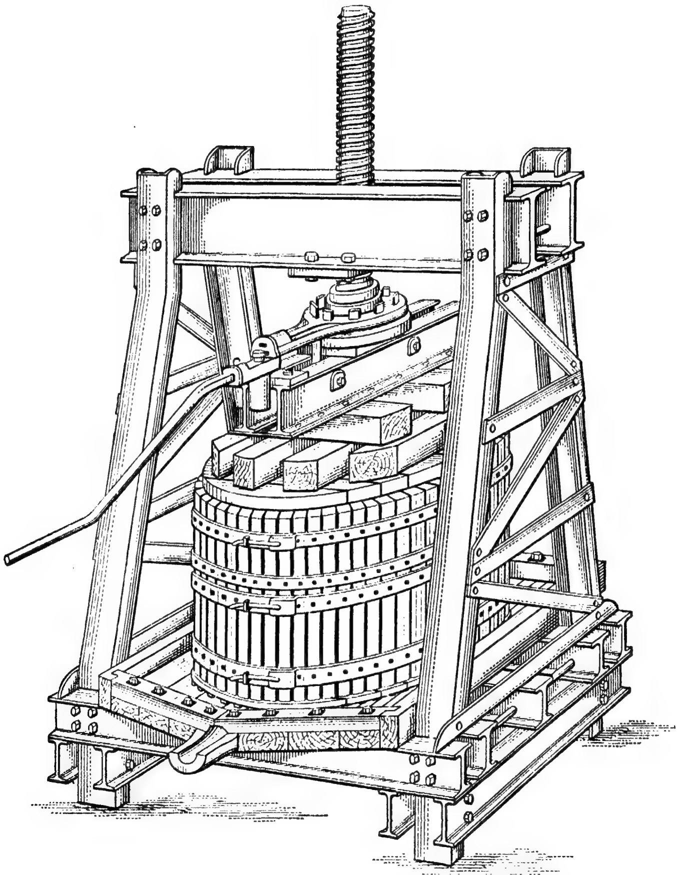


FIG. 2. Fruit juice press.

force employed. The degree of ripeness of the fruit is also of importance. In general, the condition of maturity is best, because after this period the fruit becomes mealy in structure, and the juice partially dries out and affords a lower yield. The character of the fruit must also be taken into consideration. The fruit

is usually first comminuted, but it is well known that the coarser the comminution, the greater may be the resistance of the individual particles. Berry fruits with hard shells are first to be coarsely ground, because the leathery character often renders expression difficult. On the other hand, ground fruits are more difficult to express because they afford a mash which resists expression. In this case only thin layers are expressed, and these are separated by wicker screens, which in turn offer resistance to pressure. Sometimes such mashes are mixed with chaff. Good yields are, at any rate, obtained by repacking such fruits, *i.e.*, after the first expression, remixing and subjecting to a second pressure in altered layers.

In general, fermented fruits afford a somewhat larger yield, because during the fermentation the cells are softened. When comminuted berry fruits, or fermented fruit mashes, are introduced into the press cylinders, there is obtained, without any considerable pressure at all, a freely yielded juice which constitutes between 61 and 62% of the total yield. When now pressure is applied 23 to 33% of expressed juice is obtained. The press is now allowed to stand for some time, and then further pressure is applied, and this is repeated, whereby a further 6 to 12%, and lastly 3 to 6% more juice, is obtained. The pure juice is designated as virgin juice, and obtained only to the extent of about 70% on the average; 15 to 20% juice remains behind in the residues, and this is recovered by the *secondary expression*, in which the residues are treated with water and again expressed. This supplementary juice is utilized in the fruit juice industry according to the requirements demanded.

The smaller so-called tincture presses are used for expressing alcoholic macerates. The modern methods of percolation make this expression superfluous because in the expression residue a large quantity of alcohol remains and goes to waste, while not only is relatively much alcohol required, but above all, valuable extractive matter remains behind. These small presses yield little power, and are being replaced more and more by percolation methods.

2. Mixtures and Solutions

Mixtures are understood to be combinations of various substances to form a homogeneous whole, from which, however, they may be again separated by mechanical means. It is not neces-

sary that the substances be soluble, for then a solution would result. By *solution* is understood a perfectly uniform mixture of different substances which cannot be separated by decantation, straining or sedimentation. At most they may be to some extent separable by distillation. Solutions differ from mixtures in that the former cannot be separated by simple mechanical means into their constituents, while they differ from chemical compounds in that their composition may be effected by any quantities desired of the constituents. In a solution, each constituent, according to its quantity, contributes to the characteristics of the liquid, and in general it is not necessary to differentiate between the dissolved substance and the solvent. If the one is present in very large excess, it is usually designated as the solvent, and the solution is then considered as being dilute.

The solubility of various soluble substances is very varied and circumscribed with reference to any one solvent, and for any one substance in various solvents. With inorganic substances, solubility in alcohol is usually impossible, whereas the organic carbon compounds are generally soluble in alcohol and in ether, although the solubility usually decreases with increase in the number of carbon atoms. The solubility of a substance depends upon the nature of the solvent, and also upon the temperature. It is definite for every degree of temperature and for every solvent. As a typical example may be mentioned the volatile oils, which are miscible with absolute alcohol in all proportions, but the solubility of which decreases with the decrease in alcohol strength. A higher temperature effects a more rapid and complete solubility, which is lessened as the temperature lowers. Thus solutions which are perfect while hot, precipitate a part of the dissolved substances when cooled, because solubility is decreased in the cold. This also takes place on adding water to solutions of volatile oils. These solubility limits are of importance in manufacturing, because they must be considered in the rational utilization of material. Solutions which can take up no more of the substance, are said to be *saturated*. Only under certain conditions can more concentrated solutions be obtained, and these are then designated as *supersaturated*. The solution of gases in liquids is called *absorption*, and it increases with decrease of temperature and increase of atmospheric pressure, which practical means are utilized in the manufacture of mineral waters.

3. Extraction

(a) *Extractives*

The plant appropriates from its neighborhood its nutrients, which it conducts, by appropriate means, to the parts where they are utilized; at the same time water is also absorbed. The cell sap is hence loaded with a number of substances which are dissolved therein, and with these also the elimination products of the plant. The soluble matter in the cell sap is designated as the extractive content. In practice it is important to remove the excess of water. For this purpose we utilize first and foremost the *drugs*. On drying, the extractives are also partially dried, and remain in the cell. On now treating the latter with a solvent in excess, the extractive content of the cells dissolves therein, and upon this procedure is based the manufacture of a large number of preparations used in the manufacture of essences. The simplest solvent is water, and as solubility is increased by temperature, by means of maceration and infusion, a liquid extract is obtained by the aid of boiling water, as in preparing coffee and tea. In other cases the extract yield is increased by the prolonged action of boiling water, as in decoctions. However, the character of the flavoring material is such that water cannot always serve as a solvent, because the substances originally dissolved in the cell sap are, when dried, not again soluble in water, but, as in the essence industry and for spirituous liquids alcohol is employed, the latter is utilized as a general solvent. An alcoholic extract of a drug, when moderately dilute, is called a *tincture*, and under this designation is usually understood an extract made in the proportion of 1 : 5. A more concentrated extract, 1 : 1, used particularly in pharmacy, is the fluid extract, which represents the extractive matter contained in an equivalent weight of drug. If from any extract, no matter whether made with water or with alcohol, the solvent is evaporated off, the isolated extractives remain as a residue. As the extractives tend to retain a more or less considerable quantity of water, the evaporation is usually carried out until the liquid has a honey-like consistency, and drops from the spatula with difficulty (*inspissated extracts*). When the last portions of the water are carefully driven off by drying in hot vessels in thin layers, a *dry extract* is obtained, which is reduced to powder form. Usually the latter is very hygroscopic, and hence requires to be kept in well-stoppered containers.

(b) *Extraction Methods*

The kind of solvent to be employed depends upon the character of the substance which is to be extracted, or upon which one it is desired to isolate. Thus for coffee and tea water is used when making the beverage, whereas for preparations to be kept alcohol is employed. For essences alcohol is almost exclusively used, but its strength depends upon the material as well as its power to act as a solvent, as also with reference to its use later in manufacturing, for which the essence to be made is to serve as an intermediate product. The essence is hence a stronger concentration of any given flavoring substance, which is rendered suitable for use by suitable dilution, or which is intended to be mixed with other preparations to serve as a popular beverage or food. For spirituous liquids an alcohol of 17° underproof is usually employed, and this dissolves most of the effective flavoring extractives, leaving behind the less valuable ones which, later, may readily give rise to turbidities in liquids. It is important, too, that a turbidity should not occur later on when diluting with alcohol. The chief methods depend upon maceration, *i.e.*, extraction in the cold way; and digestion, with the aid of heat. It is a fact that heat greatly accelerates and facilitates extraction, but on cooling, the extract deposits those substances only soluble with the aid of heat. On the other hand heat is prone to easily change the flavor, and in particular to impair the sensitive supplementary flavors, hence extraction by the cold way is the more highly prized. The maceration of drugs with alcohol is effected by pouring alcohol over the comminuted material, allowing the mixture to stand for a sufficient length of time at the ordinary temperature, and frequently even with unnecessary stirring, the liquid being finally either drawn off or expressed off. In doing this, however, it is impossible to prevent a part of the solvent remaining in the drug, together with the extractive dissolved in it, and this constitutes the disadvantage of this method. Even digestion does not overcome this disadvantage. The ideal method of extraction is most certainly *percolation*, which is based upon endosmosis, and which is carried out as follows: The drugs are first ground and stirred with the solvent to form a thick magma, which is then introduced into a percolator. This should have a conical form, preferably, because drugs are prone to swell, even after being thoroughly

moistened, and the pressure caused by such swelling may be sufficient to pack the drug so tightly as to prevent or seriously impair the passage of the solvent through the drug. On account of this swelling, too, the drugs are always first moistened, and hence they are ground to a uniform degree of fineness, in order that, when packed in the percolator, no canals should form through which the solvent may run off without exhausting the drug. The percolator being properly packed, alcohol of the desired percentage strength is poured on the drug to form a layer of about three to four inches, and the percolator is then covered. In about three days, the maceration may be considered at an end, and the solvent may be allowed to run off. The extraction may be considered as having proceeded as follows: The solvent penetrates the cell membrane to the cell center, where it becomes saturated with the extractive material it dissolves, and thus becomes specifically heavier and then diffuses through the membrane. Because of its greater specific gravity, the liquid sinks down, and even in the cell itself is replaced by a fresh portion of the solvent. There is thus formed a current within the cell, whereby the extract content is rendered soluble and is completely dissolved out. When, after three days or so, the cock at the bottom of the percolator is opened, a concentrated extract runs off by drops. The liquid must be allowed to drop slowly so that the column of liquid may have a constant though very slow movement downwards. The column of fresh solvent constantly pressing downwards washes out the cells to a certain extent, and it will be seen that the percolate gradually becomes lighter in color because the extractive substances have all practically gone into solution. When the volume of solvent it has been intended to use has just passed the surface of the drug, a further quantity of the solvent, or even water, is then poured on, in order to force out the solvent still in the drug, and thus obtain the definite volume of percolate desired. It would be wrong to assume that in every case the presence of a color in the later percolate portions would indicate insufficient exhaustion of the drug. The color is chiefly due to the effect of pigment-like vegetable dyes which have little to do with the extract content. The quantity of the solvent to be used varies greatly, and according as a lower or higher degree of concentration of extract is desired. Usually the percolate is divided into a first run, corresponding to about 85% of the quantity of drug

worked, and a secondary percolate which may be as large as may be necessary to fully exhaust the drug, and which is then concentrated, by distillation and evaporation, down to about 15% of the quantity of drug worked; the extract so obtained is then mixed with the portion first reserved, thus obtaining a fluid extract, one part of which contains the extractives represented by one part of drug. From the method, it will be seen that it is useless to stir the magma of drug and solvent. The method of percolation is employed in most of the extraction methods for the formulas given later on.

The extraction of large quantities, as of pharmaceutical extracts, or of dye woods, is usually effected in suitable extractors which are adapted to effect complete exhaustion of the extractives with the least amount of solvent. This is most advantageously accomplished by means of the *battery* system. The crude comminuted material is packed into a number of percolators which communicate with one another in such a manner that the contents of any one vessel runs off from the bottom on to the surface of the next vessel. The solvent is added gradually, so that it is drawn down through the material from top to bottom, whereby the drug is leached out. The extract percolate from the first vessel serves for extracting the drug in the second, and this is carried out to any extent desired, until from the last vessel there is obtained a most highly concentrated solution. The first vessel, which is now fully exhausted, is then cut out from the series, and a freshly charged vessel is included to form the last of the series, and the extraction is continued as before. In this manner the last vessel always yields a concentrated extract, which may be still further concentrated by evaporation. The process may be accelerated by the employment of pressure, which also facilitates intercommunication. This method is usually employed for extractions with cold or luke warm water, in the beverage industry, *e.g.*, in the exhaustion of dried fruits (manufacture of pomril).

For making alcoholic extracts, the so-called *extractor* is employed. This apparatus is based upon the use of the smallest feasible quantity of liquid which, with the aid of heat, is made to continuously exhaust the substance from above downwards. Any form of still will serve for this, provided that the still cover is provided with a condensing apparatus which condenses the vapors and permits the condensate to fall back on the substance before reaching

the condenser. The cover of the still, which serves at the same time as a condenser, must be of the same diameter as the widest diameter of the still or kettle. The material is placed upon a sieve diaphragm, beneath which is the extraction liquid. The vapors pass through the material from below upwards, whereby the cells are warmed and moistened. On reaching the cover condenser, the vapors are condensed and the condensate drops back upon the material and exhausts the latter from above downwards so that from the sieve diaphragm a liquid enriched by extract drips, the liquid being again transformed into vapor, the process being thus continuous. There must finally arrive a period when all the extract has been removed from the material. For purposes of convenience the liquid is then distilled off, simply removing the cover condenser, whereby the liquid extract of the concentration desired may then be run off through the cock. By passing live steam directly through the material any alcohol retained by the latter may be regained. Thorough extraction requires that the quantity of alcohol used must pass through the material five times, *i.e.*, with a charge of 1 cwt., 2 cwt. of liquid must be used, of which 1 cwt. is absorbed by the drugs while the other cwt. does the extracting. Assuming that the speed per hour of distillation is one-half cwt. distillate, the extraction would have to be carried on for ten hours in order that 5 cwt. of liquid may have passed through the material.

Another method of extraction is, in a certain sense, that of *shaking out.* In this method the object is to remove from liquids certain substances dissolved therein. For this purpose it is necessary that the shaking-out liquid be not only a decidedly better solvent, but also insoluble in the liquid to be treated. In practice aqueous or alcoholic liquids containing aromatic substances are shaken with chloroform, benzin, benzene, carbon tetrachloride or similar liquids into which the aromatic substances pass over. By distilling off the solvent, the aromatic substance is isolated in concentrated form. This method is employed for isolating aromatic oils.

4. Distillation

(*a*) *Principle of Distillation*

Distillation is primarily only the conversion of a liquid into vapor, and condensation of the vapor by cooling into liquid form

again. If the liquid is a solution of solid substances, or a solution of extractive substances, the solid constituents remain in the still, and only the medium distils over. If the liquid also contains volatile constituents, such as a volatile oil, these are also converted by the heat into vapor which mixes with the vapors of the medium and are carried over by them, so that the distillate will be a mixture of the medium and the volatile substances. Finally, distillation is also resorted to for separating mixtures or solutions of two liquids by reason of the difference in their boiling-points. As is well known, every liquid has a characteristic boiling-point, and during distillation the first liquid to pass over is the one having the lower boiling-point. On distilling a hydro-alcoholic mixture there is always obtained first an alcoholic distillate of decidedly higher alcohol strength than the original mixture. The alcoholic strength, however, gradually decreases because water vapor also passes over, while in the still itself only water remains. By careful rectification it is quite possible to more narrowly draw the line when fractionations are to be made. The principle here involved is that the vapors are subjected to a partial cooling whereby the vapors of the liquids of higher boiling-points are partially condensed, as they do not require any great degree of cooling, and thus only the vapors of the liquids that boil more easily reach the condenser where they are condensed. The rectification of alcohol, and also fractional distillation, are based upon this principle.

The principle governing distillation remains always the same, and it is only the apparatus that may vary. For ordinary purposes a simple apparatus may be used, consisting of a still provided with a tube connected with a condenser. The condenser should be provided with a return tube so as to render possible the return of the condensate, as it leaves the condenser, to the still, as is required in extracting, for instance. Thus, too, when distilling drugs with alcohol the drugs are exhausted far more rationally if distillation alone is not practiced, but if the contents of the still are rendered more completely exhaustible by a preliminary extraction. If volatile oils are obtained in free form during a distillation, they are collected in a Florence flask, and in this case a reflux condenser must surely be used because the contents of the Florence flask are constantly being returned to the still while the supernatant volatile oil is retained. Vacuum distillation takes place under reduced atmospheric pressure and a corresponding

lower temperature; and in fact the boiling-point is lowered by about 100° F. by a reduction of pressure to 700 to 720 mm. The advantages in distillation in vacuo are that aromatic substances can be obtained which are easily changed at a boiling temperature; moreover this form of distillation greatly accelerates the process because the vaporization is rendered decidedly more rapid by the removal of the moist vapors, utilizing for this purpose liquids which are of no value as end products, *e.g.*, as when making fruit juices and marmalades, using the so-called *injection condensation*, in which the condensate is not collected. On the other hand, with the so-called *superficial condensation*, the condensate is collected (see Part IV, Essence Manufacture).

(*b*) *Rectification*

Rectification, in principle, is but a repeated distillation; *e.g.*, on distilling a mash there is first obtained a weakly alcoholic liquid, which, subjected to subsequent distillation, *i.e.*, *rectification*, yields a more concentrated alcoholic liquid. Rectification is also used for the purpose of removing less valuable constituents, by changing the receiver when they are more volatile, or by collecting them in the last portion of the distillate or in the residue remaining in the still itself. The separation of the first, middle and after runs is hence a crude form of fractional distillation. The separation is effected by means of the usual distilling apparatus, but of course with a correspondingly low degree of sharpness, so that with certain products it is frequently necessary to resort to a subsequent rectification.

(*c*) *Fractional Distillation*

As already stated, the separation of the liquid constituents of a homogeneous solution may be effected by means of the difference in the boiling-points of the liquids, if for this purpose there is used satisfactory apparatus provided with obstacles of such character as to separate as well as possible the vapor mixture of liquids having approximately like boiling-points. For this purpose is used the columnar arrangement comprising any desired number of unit obstacles. As a further obstacle there is also interposed an intermediate condenser, and in every case the more easily condensable constituents are condensed and returned to the still. The boiling-point of the final condensate is always more constant,

and the product is purer. However, it is also necessary that the boiling-points of the liquids lie some distance apart, in that there should always be a large difference in the temperatures at which the individual fractional products are condensed, so that by controlling the vapor temperature of the product before the latter reaches the last condenser, the purity of the product may be insured. In the table on the rectification products of fusel oil will be found one of the most common of fractionations, arranged according to boiling-points and average yield. In the manufacture of concentrated or terpeneless oils fractionation is also employed when they are rectified without the aid of water or alcohol. The separation of the first and last runs of a distillation is also a fractionation, which in fact may afford sharply defined separate products.

(*d*) *Dry* (*or Destructive*) *Distillation*

By this is understood the heating of substances to a red heat without the employment of any medium, whereby the aqueous portions, containing decomposition products of all kinds, are first driven off. The manufacture of illuminating gas and the destructive distillation of wood are examples of this process. The latter example is interesting because it affords wood vinegar as a distillation product, containing acetic acid, methyl alcohol and acetone, while tar remains in the residue in the retort. The dry distillation of coal affords the raw material for a series of the most important aromatic compounds, from benzene to the most complex tar dyes.

5. Fermentation

(*a*) *Fermentation Phenomena*

Fermentation depends upon the decomposition of organic compounds by formed *ferments*, such organic compounds, in fact, usually being transformed into simpler compounds. Fermentation comprises the processes of fermenting sugars, rotting, decay, acetic fermentation, etc. Fermentation in the narrower sense, as it interests the beverage industry, consists in the decomposition of sugars, and is differentiated by the resulting products, as alcohol, butyric and lactic acids, and pectinous fermentation. Under rotting is understood a fermentation of albuminoid substances, usually accompanied by the formation of volatile, mal-

odorous decomposition products. We are concerned only with the fermentation effected by the aid of ferments. Ferments are nitrogenous substances which, under certain circumstances, are capable, by their mere presence alone, of causing the decomposition of organic substances without themselves undergoing any apparent change. They may hence be considered as catalysts. We differentiate between unorganized, and formed or organized, ferments. The latter are molds or bacteria, of which very small quantities are required to decompose large quantities of decomposable material, because of their very rapid multiplication. In order, however, to maintain their life work and power of multiplying, the presence of nitrogenous foods and inorganic salts is necessary. The action of these organized ferments consists in the elaboration of the so-called *enzymes*, which are albuminoid compounds having the general action of ferments. Thus, for instance, diastase converts starch into dextrin and malt sugar. The invertase contained in many plants splits cane sugar into grape and fruit sugar. Zymase is the cause of alcoholic fermentation, as it splits grape sugar into ethyl alcohol and carbon dioxide, and on this action is based the manufacture of alcohol and spirituous beverages. Fermentation is always initiated by yeast, a form of fungus having characteristic but few varieties, but which by cultivation and development in pure culture may be obtained in endless subvarieties of which certain ones act upon alcohol with the by-formation of fermentation products of aromatic character to which the name "bouquet" is given, and which impart a decided character to the various beverages. Yeast multiplies partly by branching, partly and more seldom by spore formation. After a certain quantity of alcohol has formed, the yeast ceases to multiply, but continues to cause fermentation, and only when the fermentation is at an end, and all nutrient matter present has been split up as food, does the yeast die of hunger. In order to maintain fermentation it is most important that the most suitable nutrient be present. For this purpose there are used nitrogenous organic products, such as asparagin, pectin, etc., as well as inorganic salts, particularly such as the ammonium salts and phosphates. Further, the temperature must be such at which the yeast may develop; and it averages 65 to 77° F.

Alcoholic fermentation is employed in making fruit juices, to which wine also belongs. The fruits themselves have sufficient

yeast to initiate fermentation. Fermentation sets in spontaneously, but these so-called wild yeasts are prone easily to create disturbances, or may give rise to diseases, hence pure yeast is always used, *i.e.*, cultures of certain favorable strains possessing special fermentative powers, and which repress the action of the wild yeasts. The initial stage of the fermentation, or main fermentation, is turbulent in character, being accompanied by the formation of a frothy scum on the surface, because the formation of alcohol is accompanied by the separation of insoluble pectinous substances. After the major portion of the carbon dioxide has been evolved, the fermentation becomes quieter, the secondary fermentation then setting in, during which the last portions of the sugar are fermented. The fermentation reaches its natural limit when about 15% of alcohol has formed, because alcohol is a poison to fermentation, and prevents the latter from continuing. Besides alcohol, there are formed a number of other substances, which we designate as fusel oil, and which afford the "bouquet." In addition, some glycerin and succinic acid are formed. On the whole, two parts of sugar afford one part pure alcohol, and hence, knowing the sugar content of the mash, the yield of alcohol may be estimated. According to Pasteur, 100 parts of cane sugar yield on an average 48.4% alcohol, 46.6% carbon dioxide, 3.3% glycerin, 0.6% succinic acid and 1.1% fusel oil and yeast substances.

Disturbances of fermentation may be occasioned by unsatisfactory temperatures, lack of nutrients for the yeast, the occurrence of acetous fermentation, by the presence of an excess of sugar, and lastly by the alcohol limit having been reached. The disturbance can be removed only by removing the cause. If acetous fermentation occurs, its cause is very difficult to remove. The bacteria must then be removed by pasteurization, and the fermentation initiated again by means of a pure yeast. The acetous fermentation, it is well known, is very prone to accompany alcohol fermentation. It is caused by the acetic acid bacteria which are almost always present, but which require oxygen for their development. The formation of acetic acid can take place only with free access of air, hence when preserving fermented liquids the access of air must be prevented as much as possible.

(b) *Diseases and Faults of Fermented Liquids*

The true *diseases* are those changes caused by microörganisms. We speak of *faults*, when the changes in the composition of a beverage have not reached a point where they give rise to permanent deterioration.

Ropiness is caused by a mold which requires oxygen for its development, and which is usually found on the surface of the liquid, but which gradually sinks to the bottom and may render the liquid turbid. The action of the mold consists in further splitting the alcohol into carbon dioxide and water. It is very sensitive to alcohol, and does not develop in liquids containing over 10% alcohol. The mold is most rapidly killed by pouring strong alcohol over it, when on the surface.

Acetous fermentation is a very frequent fault in fermented liquids, and it is the more serious, when not all the sugar is fermented, because the latter serves as a nutrient for the bacteria. At all events the acetic acid content is covered by a high content of extract, alcohol, sugar and tannin, and up to 0.2% acid may then be present, though at times the presence of 0.1% acetic acid is evident on tasting. Neutralization of the acetic acid is not feasible, because the other acids may also be neutralized. The prevention of the continued formation can only be effected by pasteurization.

Lactic fermentation occurs in acid-poor juices, in that the sugar is converted by the lactic acid bacilli partially into lactic acid; and even the malic acid present in non-acid wines is split up by the bacteria to form lactic acid, and thereby a reduction in acidity is effected particularly in wines and fruit wines. In serious cases the wine acquires a strong odor, and requires to be pasteurized and refermented with the aid of a pure yeast.

Among the most characteristic diseases of fermented juices, particularly wines and fruit wines, is ropiness. The fluid character of the liquid is lost, and the liquid becomes mucilaginous in consistency, and to such an extent in fact as to yield threads on pouring. The cause is mold, and the ropiness develops in fermentation products that contain but little tannin. As a rule, the product requires to be whipped, whereupon the mucilaginous particles subside on the addition of fining agents; and in addition tannin has to be added.

The *souring* of fermented liquids is of itself a normal phenome-

non, and may develop into a disease only when it occurs at a time when the liquid should be clear, or when, if clear, it has again become turbid. The turbidity may be due to albumin, or albumin-tannin compounds, or also to yeast or bacteria, which destroy a large part of the bouquet. To this disease also belongs the darkening of vinous beverages, wherein particularly colorless liquids become more or less green, gray or black, in contact with air. Colored beverages then usually deposit a blackish precipitate. The coloration is due to the presence of iron and tannin, and in fact occurs in apple wine for instance most frequently, although tartaric acid often prevents it. To correct this there is necessary a thorough filtration after the addition of more tannin to remove the excess of iron. At the same time it is recommended to fine the liquid with isinglass or gelatin. Another disease is the *browning* of fruit juices, as, for instance, of lemon juice. This is caused by the oxidation of various so-called oxydases which are present in the plant juice, and which become converted into brown, humus-like compounds, but which yield coloring matter removable by charcoal. The *bitterness* which fruit juices sometimes develop also often occurs in liquids rich in tannin, and in such cases the juice must be fined with milk, and if necessary refermented. A not infrequent occurrence is the development of a *mousy* flavor in the fruit juices and fruit wines. This seriously impairs the taste, and gives rise to a repulsive after taste, due to the volatile acids present and which result from an improper fermentation, or when the juice remains too long in contact with the yeast. The taste is very difficult to remove, although it may sometimes be done by the aid of charcoal. Lastly, the *moldy* taste sometimes developed must be mentioned. This fault, which may be prevented much more easily than it can be removed, is usually due to the employment of moldy casks. It sometimes disappears of itself, otherwise it must be removed by fining and filtration; this is accomplished most effectually by means of wood charcoal, although this is very prone to remove some of the volatile aromatic substances.

6. Preserving

(a) *The Object of Preserving*

All nutrients are subject to decomposition after a more or less brief time, although by suitable means of preservation the dete-

rioration may be postponed for a long period. The problems of preservative methods lie in commercial and hygienic domains, and are concerned with the prevention of injury to the health, which may be caused by the ingestion of spoiled foods. The cause of the decomposition itself is microörganisms, which not only develop the external phenomena of decomposition, but develop from albuminoids substances closely allied to the poisonous ptomaines.

The preservative method must be adapted to the character of the nutrient, the chief object being the destruction of the bacteria or organisms, or the prevention of their further development. For their growth are required a temperature of 50 to 115° F., access of air and presence of water. If one of these requisites for life is absent, any bacteria present cannot develop and give rise to the phenomena attendant on their growth. Such an effect, however, may also be obtained by means of certain chemicals, the so-called antiseptics, which exert their effect according to their character and the quantity used. In the employment of such substances, however, it is important that they be non-injurious to the human being, or at least are so in the minimum quantities required.

It is necessary that the decision of the public be made easier as to whether a nutrient is pure or has been in any way preserved, and in so far as this is not evident from the designation or character of the product, it is to be declared, and in fact the character of the substance used should be stated, so far as it does not relate to inoffensive substances such as sugar, vinegar, oil and sterilized products.

(*b*) *Preservative Methods*

The simplest preservative method is that of the withdrawal of water by *drying*, by which means our drugs and dried fruits are prepared. We are more concerned with the manufacture of stable preparations by *heating*, partly with, partly without, simultaneous inspissation, in open or closed vessels. Furthermore, in the case of fruit juices, *cooling* and *freezing* also come into consideration.

As additions to stable products a number of various substances may be used, the employment of which must depend upon their practical value or eligibility within definite limits.

A simple method of preservation consists in the addition of alcohol, and this is adapted particularly for fruit juices which are

intended for subsequent use in alcoholic beverages. Bacteria cannot live in an alcohol of 42° underproof. The employment of alcohol for non-alcoholic beverages, however, is very troublesome, because even though the alcohol may be distilled off, a loss of flavor occurs also.

Sugar is also used as a preservative, and in fact its action depends upon the principle of dehydration, because the quantity of sugar used approaches almost the saturation-point, and abstracts the quantity of water necessary for solution from the substance to be preserved. Among the preparations so preserved are the fruit syrups, jellies and marmalades. The pouring of a layer of *fat* or *oil* on the surface of nutrients is to prevent the access of air, but this is utilized only for nutrients of animal origin, which is also the case in preserving by means of salt, saltpeter, borax, boric acid, sulphurous acid and sulphites, alkalies, chlorates and dithionates, hydrogen peroxide and copper salts. *Sulphurous acid* is most practically employed for sulphurizing the casks before placing in them the easily decomposable substances. For our purposes, the preservatives in question comprise a number of acids, such as hydrofluoric, salicylic and benzoic acids. The acids all exert an antiseptic action, which, in the case of some, particularly the inorganic acids, is quite pronounced, but yet most of them cannot be used because of their toxicity. Even acetic acid will kill yeast.

The oldest preservative is without doubt salicylic acid, which, even today, is freely used in domestic practice. It is a natural constituent of a large number of fruits, such as strawberries, raspberries, etc., on which it is now believed that the substance also exerts a certain preservative action. As the wholesomeness of fruits, even though they contain salicylic acid naturally, cannot be questioned, it is not at all likely that the acid will have any injurious action on human health when employed within suitable limits. Such limit may be assured as 0.05%. However, medical authorities are not all agreed on this point, hence the use of the acid is forbidden in many countries.

Formic acid is found as such not only in ants, but in honey, which may be assumed to contain 0.11% on an average. Nevertheless, the action of formic acid on the internal organs, and particularly on the kidneys, is questionable, because it is eliminated unchanged from the system, and hence medical authorities are

inclined to the belief that it is injurious to health. Where it is permitted, the highest limit is 0.25%, calculated on the pure acid. Its employment is very convenient as the quantities to be used are so easily controlled. Formic acid belongs, further, to the volatile acids, and some of it is lost on boiling liquids containing it. Besides it must be remembered that in the course of time it forms an ester with the alcohol used for preserving fruit juices, whereby its effectiveness is naturally impaired, which hence renders necessary a frequent control of the stock preserved.

Benzoic acid has also been found in many fruits, particularly in the cranberry and strawberry. Its power as a preservative is about that of salicylic acid, and the greatest quantity to be used is also to be placed at 0.05%. The benzoates act similarly, as the free acid is liberated in acid liquids. Mention must also be made of *hydrofluoric* acid, of which 0.017% calculated on the pure acid, or 0.04% of the technical (about 45%) acid, is sufficient. This acid, however, is not entirely unobjectionable as a preservative, and it could not well be used were it not precipitable as a calcium salt by the addition of chalk, the insoluble calcium fluoride precipitating out. The preservation with hydrofluoric acid constitutes therefore an intermediate stage with which the consuming public has nothing to do directly, but which concerns only stock goods from which the acid is to be removed before such goods are used.

The method of preservation by *inspissation* depends upon dehydration. The extractives are concentrated, and no longer serve as a nutrient medium decomposable by bacteria. The purpose of the inspissated nutrients is to afford again on the addition of water a preparation which, in regard to taste, odor and other properties, should fully resemble the food product before it is inspissated. Sugar is also largely used at the same time as a thickening agent.

(*c*) *Sterilization*

The numerous methods of sterilization depend upon the action of heat on food products whereby the bacteria in or about them are destroyed, and also upon preventing the access of any other decomposition organisms during the preservation of the sterilized substance. The first of these methods was proposed in 1809 by Appert, who boiled the food product for some time, then introduced it into glass or tin vessels which were heated for some time

in a boiling water-bath and then perfectly sealed before a temperature of 212° F. had been reached.

Later on, Pasteur introduced the method of preserving liquid food products by the process now known as *pasteurization.* In this method the liquids are not heated much above 140° F., in order to prevent the development of an undesirable by-taste. Most of the sterilization methods are based on this method, the greatest value of which consists in that any subsequent action of bacteria is prevented by the absolute exclusion of air. This is accomplished most surely by using glass or tin vessels, and even with wooden containers provided these are made absolutely airtight. The various methods in use are described fully in Part IV.

There remains only to be mentioned that sterilization at the temperature given and for a period of half an hour suffices to kill all bacteria, but that certain varieties of resistant germs, and particularly the developmental stage of bacteria, the spores, are not destroyed. It is possible, however, that these will have developed within about two days, and hence it is advisable to repeat the operation after two days in order to make the sterilization thorough.

7. Sugar Products

Sugar is one of the most important of food products, and serves in most cases as a taste corrigent, as it improves the taste of the most varied natural products. Cane sugar is almost exclusively used as a sweetener, as the cheaper grape sugar or glucose serve only as substitutes or as thickeners, as for instance in marmalades and jellies. As is well known, cane sugar is converted by the action of invertase into the so-called invert sugar, which is predominantly present in fruits. This inversion, however, may also be effected by the hydrolytic action of acids, *e.g.*, by fruit acids, when these are boiled with sugar for some time. For practical purposes a sugar or fruit syrup is usually made by boiling 60 to 65 parts of sugar with 35 to 40 parts of water or fruit juice. A trade form of liquid sugar, designated *liquid raffinade*, with a sugar content of about 80%, is made by boiling 80 parts by weight of cane sugar and 30 parts by weight of water, with the addition of an acid, until inversion is effected. For example, 0.25% of pure phosphoric acid suffices for this purpose, the inverted syrup being

then evaporated down to 100 parts by weight. On the large manufacturing scale the indifferent carbon dioxide is used instead of phosphoric acid.

More recently the *cold process* of dissolving sugar to make an approximately 66% syrup has been introduced, the special apparatus for this being shown in Fig. 3. By means of a layer of porous filtering material the permeability of the sugar, which with the water is placed in the upper part of the apparatus, is regulated, so that a syrup of approximately uniform strength constantly drops into the receiver. Although this process is not particularly rapid, yet it is adapted for supplementary use where large quantities of sugar are not required to be handled. The process is especially useful for fruit juices because by operating in the cold the flavor is retained better, and no separation of albuminous substances occurs. It is particularly advantageous for syrup made from lemon juice, which is very sensitive to heat, and for which therefore the cold process is preferable.

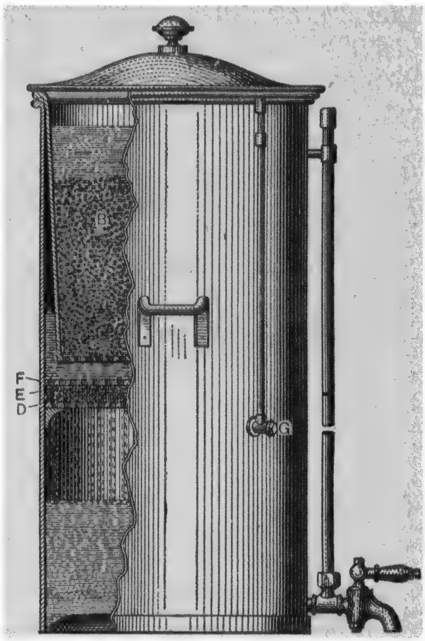


FIG. 3. Sugar dissolver (Barrucand's). *B*, sugar container, arranged for suspension. *D* and *F*, sieves, between which lie *E* the filter. *G*, air-vent tube.

For syrups that have to meet the requirements of the pharmacopœias this method cannot be employed.

As is well known, honey, the product of the bee, consists chiefly of grape sugar, and in the manufacture of *artificial honey*, the raw material, cane sugar, is inverted in the usual manner, and from the syrup so obtained there separates in the cold crystalline scales of grape sugar which differs little from honey in nutrient value. The taste and flavor are usually imparted by adding true honey flavoring, *e.g.*, honey flavoring oil, and coloring to suit. To inferior grades there is also

added some ordinary glucose, or even powdered cane sugar, in order to impart a better consistency.

It must be mentioned, further, that inversion takes place only at the boiling temperature. There then form levulose and glucose; the latter, being the less soluble, gives rise, in highly concentrated liquids, and particularly in the cold, to the crystallization observed in fruit juices. In this, however, a number of other circumstances take part, and which probably are owing to the nature of the juice. In the manufacture of fruit syrups, hence, it is necessary to maintain a boiling temperature for as brief a period as possible, and to cool the boiled syrup rapidly. Syrups that have crystallized may be restored to their proper condition by reheating with the addition of a small quantity of water.

When sugar, or glucose, is heated to above 360° F., there forms sugar coloring, or *caramel.* This is an amorphous mass, no longer sweet or capable of being fermented, and of intensely brown color and characteristic empyreumatic taste. Its manufacture is effected in large kettles with not too large a charge, and with careful regulation of the temperature in order to avoid burning the product, which would impair the solubility of the caramel. As a rule the raw caramel is dissolved in water to purify it by sedimentation and filtration, the liquid being then evaporated in vacuo to the consistency of an extract. It is thus marketed as *vinegar coloring,* which must be perfectly soluble in water. This quality, however, is rendered soluble in spirituous liquids by treatment with alcohol. Thus sugar coloring to be used in the alcohol industry is dissolved in alcohol of 20° overproof, and the solution filtered and evaporated. This kind of caramel, called *rum coloring,* must dissolve in liquids of 20° overproof strength without the slightest residue. Sugar coloring is used as a coloring in all cases where tar dyes are inadmissible, and particularly in the liqueur industry, because its characteristic empyreumatic taste desirably rounds out the taste of the preparations.

8. Turbidity of Liquids, and Its Removal

It is necessary that, to the eye, most of the beverages consumed must be perfectly clear and transparent. The inferiority of a beverage not strictly clear and transparent is not due in any way to any injurious action or other material inferiority possessed by a turbid beverage per se, but is due to the psychological effect on

the eye. It is for this reason that beverages are taken preferably from transparent vessels, as both the imagination and appetizing appearance already combine to enhance the value of the beverage.

Turbidities may owe their origin to the most varied causes, and in order to remove them it is necessary to ascertain the causes. In all cases there are mechanical separations due to some substance not having completely dissolved or, when dissolved, having been precipitated from the solution by any cause whatever. According to the degree of separation we differentiate between a more or less dense turbidity or an opalescence. The removal of the turbidity may be effected in all cases by *filtration*, in that the liquid is passed through some substance the pores of which mechanically retain the particles causing the turbidity. This suffices for the more or less dense turbidities, using for this purpose filter paper or paper pulp, or cellulose; for the coarser mechanical impurities straining through flannel or other fabric even suffices. For this there is employed the so-called filtering bag or felt hat, wherein the mechanical impurities are retained while the clear liquid runs off. A combination of such fabrics form the Holland filter. In this, a number of filtering tubes are contained in a cylindrical vessel, the tubes being filled by means of a common reservoir, the liquid running off being returned until the filtrate runs off clear. The clearest filtrates are obtained by means of filtering papers of the most varied thickness, the filtering surface of the filter being increased by creasing the paper into many folds, or by providing the funnel used with projections that prevent close contact of the paper with the funnel sides. More rational is the use of perforated funnels provided with folded filter papers, which render possible the rapid running off of the filtrate through the perforations. Still more rational is the sieve filter, consisting of a cylindrical vessel provided with a conical, internally fixed sieve made of a fine-meshed metallic tissue, for which is required some filtering medium that, according to the size of its particles, suffices to fill the pores of the sieve. Using this filter, filtration is greatly facilitated.

Filtering media are particularly desirable to use in cases where the turbidity is difficult to remove, as, for instance, the opalescence caused by the presence of traces of volatile oils or terpenes, which afford a milky liquid. The filtering media, besides stopping the pores of the filter, also carry down with them the purities, as, for

instance, is the case when using infusorial earth. Even asbestos has a similar action. For volatile oils, light calcined magnesia is a particularly good filtering medium, but it cannot be used for acid liquids. Kaolin is also used, but more rarely. In all cases, a portion of the liquid to be filtered is first mixed with the filtering medium, and the mixture is poured on the filter. The filtrate is at first turbid, and must be returned to the filter until, after the filtering medium has settled in the pores of the filter, the

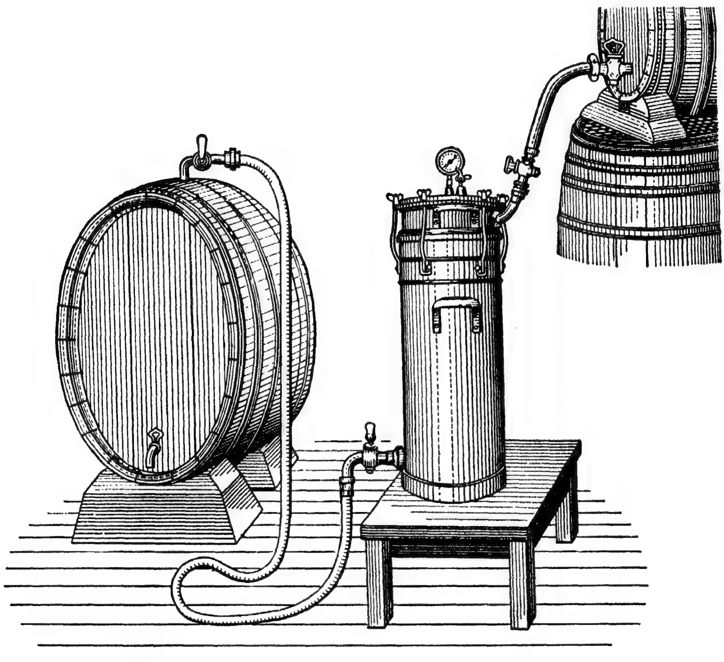


FIG. 4. Small pressure-sieve filter for alcoholic liquids.

liquid runs off perfectly clear, after which the balance of the turbid liquid is poured on the filter as required. The rapidity of filtration depends upon the viscosity of the liquid to be filtered, and is the more difficult the more viscid the liquid. The rapidity is increased by pressure, which is most simply applied by using a closed filter and raising the liquid to be filtered to a higher level. On the other hand, direct pressure may also be utilized, as, for instance, by increasing the air pressure on the surface of the liquid to be filtered.

In general, filtration is the poorest means of clarification, particularly for essences and alcoholic liquids, because it always gives rise to losses, the loss especially of alcohol from alcoholic liquids by volatilization being quite an item. For such liquids there are hence used *clarifying* or *fining* agents, the purpose of which is, when stirred with the liquid, to settle and carry with them mechanically the particles causing the turbidity. Allowing the liquid to stand is, of itself, already adapted to facilitate the deposition of these particles, but the deposition is usually rendered

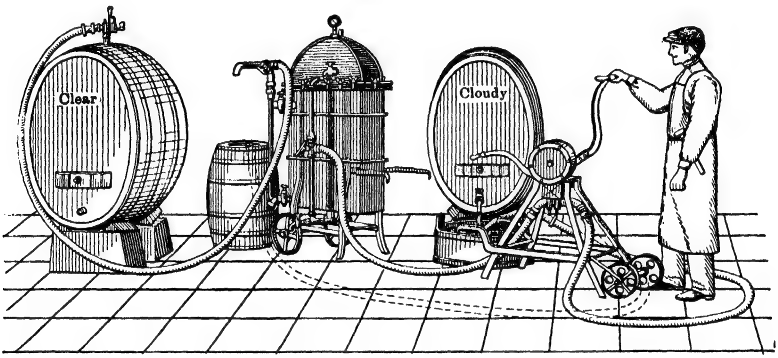


FIG. 5. Large pressure-sieve filter for fruit juices and wines, with pressure pump.

difficult when these particles have about the same specific gravity as the liquid, or when the latter itself is the heavier. The clarifying agents are usually gelatinous substances, such as gelatin, isinglass, albumin and casein. All of these substances have the property of separating in flocculent form in alcoholic or acid liquids, whereby the flocculi inclose the particles causing turbidity and carry the latter down with them on standing.

The simplest clarifying agent is *skimmed milk.* When added, its casein immediately separates to form a decided turbidity, but on standing several days, it forms a dense sediment beneath the clear liquid, which then only requires to be filtered off. For this purpose $\frac{1}{2}$ pint milk suffices for 10 gallons of liquid.

Albumin is particularly useful for aqueous liquids. The albumin of fresh eggs is beaten to a snow, and then stirred with water, the whites of five eggs sufficing for 10 gallons of liquid; or, using dried albumin, this is dissolved in cold water, 30 drams of the

solution then sufficing for 10 gallons of liquid. The solution is stirred with the cold liquid to be clarified, and then the liquid is heated to the temperature at which the albumin coagulates, which is about 158 to 180° F. The albumin as it coagulates incloses the particles causing turbidity, and thus effects clarification.

Gelatin and *isinglass* are gelatinous substances which are slowly precipitated in alcoholic liquids, and which have the property of affording insoluble compounds with tannin, which compounds also inclose the particles causing turbidity and carry them down. It is customary to employ for 10 gallons of liquid a solution of ¼ to ½ oz. of isinglass or ½ oz. gelatin; and for liquids which contain no tannin naturally, there is first added for a like quantity ½ oz. tannin, the further procedure being then as already stated. It must be remarked that the color of the filtered liquid is always darker than before filtration. In all cases clarification by allowing the liquid to stand, either with or without the use of clarifying agents, is preferable to filtration.

9. Use of Wood Charcoal for Removing Taste and Dyes

It may happen that, for some reason or other, liquids may become discolored, or may acquire a by-taste, which injures the appearance or flavor. To remove these, any porous charcoal may serve, but usually wood charcoal is used. Animal charcoal, obtained from bones, and freed from minerals, is also used, and also more rarely charcoal from meat. The action of the charcoals consists in abstracting the coloring or flavoring substances, storing these in the pores, and thus removing the objectionable constituents from the liquids. The coloring matters are always retained by the charcoal, and are removed particularly from liquids which are only slightly colored, and which possess a light-yellow or brownish tint. The charcoal does not act on concentrated pigments of vegetable origin, and hence it is not possible to decolorize extracts.

Regarding flavoring substances the matter is different. Its power to remove flavors is based upon the fact that it removes and stores up for some time in its pores substances of higher molecular weight than that of the liquid. The power to remove flavoring substances is hence spontaneous, but after a while, say about two days, the separated flavoring substances again go into

solution if the charcoal charged with them is not removed from the liquid.

For the purification of alcohol, charcoal is used in the form of small pieces through which the liquid must be made to pass slowly. Otherwise, powdered charcoal is mixed with the liquid in the proportion of 1 : 100, the mixture often stirred, and filtered after several days.

For refined spirits and liquids having a slightly foul odor, usually due to the presence of over-ripe or partially decomposed fruit during the fermentation, it is advisable to add to the liquid some solution of lead acetate, which precipitates the offending substances. As, however, lead acetate is very poisonous, the regenerated liquid must be redistilled.

B. Analytical Methods

1. Temperature Conditions

The temperature at which a change occurs from one state of aggregation to another is perfectly definite for each substance. It is well known that heat expands all bodies, which, whether liquids or solids, are thereby made to undergo a certain oscillation, the speed of which increases with the rise of temperature, until the cohesion is overcome and can no longer maintain the molecular equilibrium. Solids then pass into the liquid form, and liquids into the gaseous. The reverse takes place on cooling. To overcome the cohesion requires a certain amount of heat, which is thereby used up. The temperature then remains constant until all the solid is melted; and this is termed the *heat of fusion,* while the temperature is termed the *melting-point.* On heating liquids an increased evaporation takes place, because, after the cohesion is overcome, the molecules in the space above the liquid fly off, the particles of the substance pass into a gaseous form, and finally the oscillation becomes so rapid that the air pressure is overcome and the liquid begins to boil. Now the temperature, which is termed the boiling-point, remains constant until all the liquid has become gaseous.

Solids which are capable of being liquefied are designated as fusible; and such as may be evaporated are termed fluid. The melting-point is the temperature at which solids become fluids. It coincides with the *freezing-point,* or *solidification-point,* or

congealing-point; nevertheless, under certain conditions some substances may be cooled below their solidification-point without becoming solid. Through a shock, however, such sub-cooled substances suddenly solidify, while at the same time the temperature rises to the melting-point.

The temperature at which these changes take place is definite for every substance, and hence from its determination conclusions

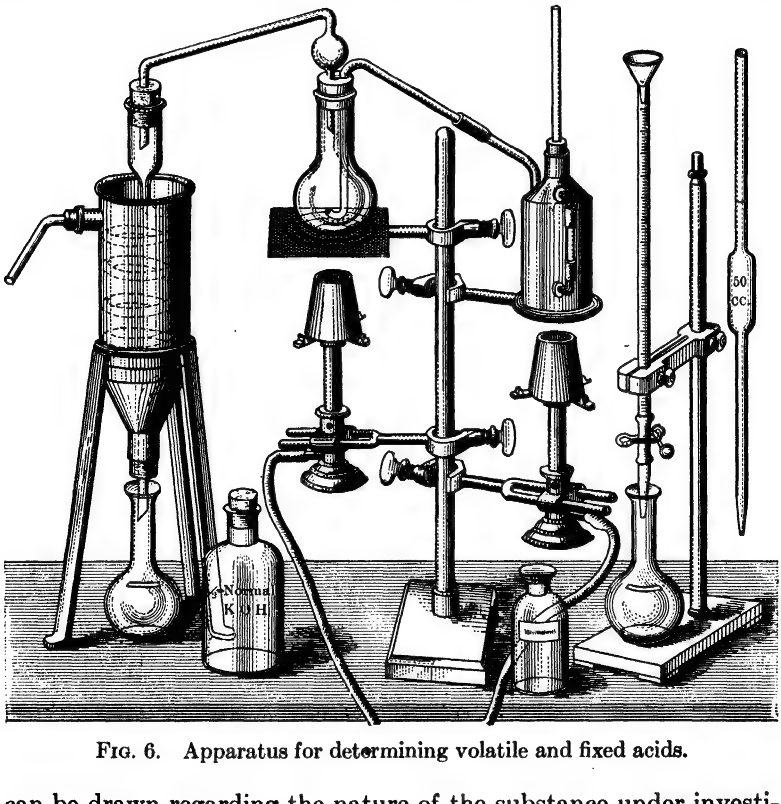


Fig. 6. Apparatus for determining volatile and fixed acids.

can be drawn regarding the nature of the substance under investigation. The temperature is ascertained by means of a column of mercury, which, for scientific purposes, is divided into degrees according to the scale devised by Celsius. The Reaumur scale is antiquated. Ten degrees of the Celsius scale corresponds to 18° of the Fahrenheit or 8° of the Reaumur; in making calculations, however, it must be borne in mind that in the Fahrenheit scale the freezing-point of water lies at 32°, while it lies at zero in both

the Celsius and Reaumur scales. The difference between the boiling- and freezing-points is divided, in the Reaumur scale, into 80°, in the Celsius scale into 100° and in the Fahrenheit scale into 180°, so that the boiling-points are 80°, 100° and 212°, respectively, for the Reaumur, Celsius and Fahrenheit scales. For the sake of uniformity the practical temperatures used in this work are those according to the Fahrenheit scale.

The determination of the melting-point is effected by heating the substance in a porcelain dish on a water-bath with sufficient, but moderate, heat, and observing the temperature remaining constant until just before all the substance has melted. Conversely, in determining the solidifying-point, particularly of certain volatile oils, such as anise oil, a sample of the oil is immersed in a cold mixture in which a thermometer is also held, and the critical point is read off. In doing this the oil is first subcooled to a point about 5° below its solidifying-point. Solidification is then initiated by stirring, and it occurs with the evolution of heat. The maximum point at which the solidification occurs is called the solidification-point. This method is practically applied to oils of rose and anise. Oil of anise solidifies at 70 to 72° F. It is subcooled to about 60° F., and then brought to the solidifying-point, whereupon the temperature rises to the solidifying-point at which it remains constant, and is then read off.

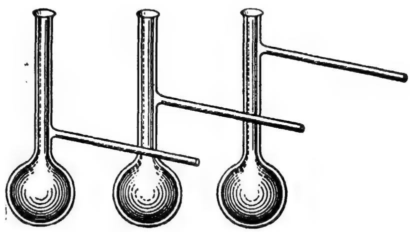


Fig. 7. Flasks for determining boiling-points.

The boiling-point is determined by aid of a so-called distillation flask, Fig. 7, in which are placed a few fragments of porous clay which prevent the bumping that may occur when the pressure on the boiling liquid is irregularly overcome, giving rise to explosive ebullition. In the neck of the flask is fastened the thermometer, which must be fully surrounded by the vapors before they reach the condenser. Although every liquid has a certain definite boiling-point, yet this is seldom constant in the case of mixtures, because the constituents of these may pass over at different stages. It is hence almost impossible to determine the boiling-point of a

mixture, and the value of a statement as to the boiling-point lies only in the fact that the majority of the substances present volatilize at a definitely constant temperature. Otherwise, a *fractional distillation* is practiced in a small way, because by aid of such correct analytical processes the passing from one boiling-point to another is easily observed, as it is a physical rule that a liquid remains at the same temperature during boiling until all has been rendered gaseous at this temperature. The temperature then jumps to a higher point, at which it remains until everything boiling at this temperature has been rendered gaseous. The determination of fusel oil is an example in point, of which the fractionation in the large way is given in Part II, together with the boiling-points and boiling-point limits, etc. In practice 50 cc. of a liquid to be investigated are heated to boiling, and the thermometer is read when the first drop of liquid condenses; as soon as the temperature shows any considerable rise, this is noted, together with the number of cubic centimeters of condensate in the graduated receiver — and this procedure is repeated until all the distillate has been received, the residue being calculated as the difference between 50 cc. and the volume of distillate obtained. The valuation is based upon the percentage of the particular constituents obtained within the limits of the boiling-points of the substances sought, and which are to serve as the standard.

Steam, under the usual conditions of pressure, has a temperature of 212° F. Steam may, however, be subjected to greater pressure, and in fact the pressure under which it may be held is called atmospheric pressure. The temperature of the steam under various pressures is as follows: One-fourth atmosphere, 221° F.; one-half atmosphere, 232° F.; one atmosphere, 250° F.; two atmospheres, 267° F.; three atmospheres, 293° F.; four atmospheres, 309° F.; and five atmospheres, 320° F., etc. Such temperatures are required in cases where constituents boil at these points, or where heating has to be hastened in order that the steam under pressure may afford a greater degree of heat. It would be incorrect, however, to assume that, using steam under pressure, a higher degree of heat develops within a still than corresponds to the boiling-point of the liquid originally. Steam under pressure is also used for distilling off substances by direct passage through the materials, the pressure then hastening the speed and increasing the yield of the higher-boiling constituents.

To obtain low temperatures, use is made of ice, or, more rationally, the so-called *freezing mixtures*, by mixing ice with easily soluble salts, particularly sodium chloride, calcium chloride or ammonium chloride. For cooling vapors, such as are usual during distillation, ordinary water suffices, and only for the low-boiling esters and ethers is ice necessary. The quantity of cooling water required depends naturally upon the speed with which the vapors pass through the condenser, but for the ordinary distillation referred to the normal heat of water, the condenser surface should equal the heating surface of the still in extent. When operating under reduced pressures (in vacuo), it must be at a lower temperature. The boiling-point of a liquid is the lower the less the atmospheric pressure on it. For instance, on high mountains water boils at 194° F., and in an absolute vacuum at 86° F. Ordinarily an air pressure of 0.680 to 0.720 mm. mercury is employed, whereby the boiling-point of the liquids is lowered approximately 100° F., and this is important in manufacturing high-boiling esters which would not distil at the temperature of steam under pressure.

It is a remarkable fact that steam possesses the properties of carrying with it forcibly and without decomposition the volatile constituents of other high-boiling substances despite their high boiling-points, and upon this depends the distillation and rectification of difficultly boiling liquids with steam with which they condense on cooling, and if not soluble in water, separate as a distinct layer.

For scientific determinations a *normal temperature* has been adopted, of 15° C. (= 12° R., or 59° F.). This is used in all cases where physical determinations are in question and wherein definite data are to be determined which may be characteristic of a given substance, for instance, the specific gravity; and this employment is based upon the action of heat in expanding all bodies and changing their volume.

2. Solubility

Solubility is a physical constant for every substance, and depends upon the solvent or the temperature. The solubility investigations are confined to effecting the solution of the solid substance in water or other medium so as to obtain a saturated solution, and from this, to determine the solubility. Rather

more important is the determination of the solubility of liquids in other liquids, as is particularly the case with volatile oils. The determination is practically carried out by mixing 0.5 cc. of an oil gradually with an alcohol of definite strength until a perfect solution is obtained. The volume of the mixture is then compared with the volume of the oil used. If any of the liquids contain aqueous constituents, this may be ascertained by shaking with ethers, whereby the volatile constituents dissolve in the ethers. In this manner the aromatic odorous constituents are identified, as, for instance, in essences, fruit juices, etc., by shaking with benzene which dissolves out the flavoring constituents, which are then left behind and thus isolated when the solvent is evaporated. The shaking-out methods may also be based upon the action of a medium upon any aromatic substance whereby the latter is in any way decomposed. Upon this action is based the aldehyde determinations, as, for instance, in cassia oil, in which the volatile oil is boiled with a solution of sodium bisulphite whereby the aldehyde passes over into the aqueous liquid. By this means it is shaken out and the non-aldehydic residue determined, the aldehyde content being ascertained from the difference. In similar manner the phenol determination is made for clove oil. In this the phenol is saponified with alkali and rendered soluble, while the insoluble unsaponifiable terpenes form a layer, the volume of which may be read off.

3. Specific Gravity

By the term *specific gravity* we understand the weight in grams of one cubic centimeter of the substance in question, employing as the normal temperature 15° C. = 50° F. The specific gravity is based upon that of water for purposes of comparison, namely, that 1 cc. of water weighs at 4° C. exactly 1 gm. From the specific gravity of a solution we may, for instance, ascertain the quantity of substance in solution; moreover the specific gravity affords a standard for the purity of substances, as impurities present effect variations in specific gravity.

The specific gravity of solids is determined by first weighing them in the air, and then in a liquid the specific gravity of which is known; from the difference in weight the specific gravity is determined. For this purpose the hydrostatic balance is used, Fig. 8. For instance, if a solid weighs in air a grams, and in

water b grams, its specific gravity is calculated from the formula

$$S = \frac{a}{a - b}.$$

The specific gravities of liquids are determined by aid of either the chemical balance or areometers. When using the balance

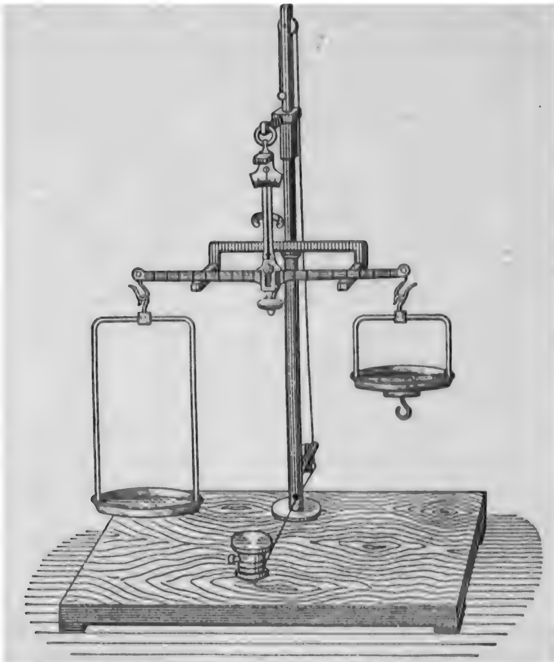


FIG. 8. Hydrostatic balance.

it is most advantageous to employ the picnometer (Fig. 9). This is a small flask made to hold say 50 cc. exactly of a liquid, and it is provided with a thermometer ground or cut to fit accurately. The flask is first weighed when empty, and then when completely filled with liquid brought to the temperature of 15° C.; from the difference in the net weight and the specific gravity of the water, the specific gravity of the liquid is determined. For instance, were the net weight of the filled 50-cc. flask 48 gm., then the specific gravity of the contents would be 0.48.

The specific gravity balance, Fig. 10, has a beam, one end of which carries a weight which serves at the same time as a ther-

mometer, and which is to be immersed in the liquid to be tested; the other end of the beam is graduated decimally, so that by the use of proper riders the specific gravity may be ascertained to the fourth decimal point.

The simplest method of determining the specific gravity is by means of the areometer, Fig. 11. This consists essentially of a glass spindle, one end of which is weighed with mercury or shot; using mercury, this is made at the same time to serve as a thermometer, for all determinations are to be made at 15° C. The

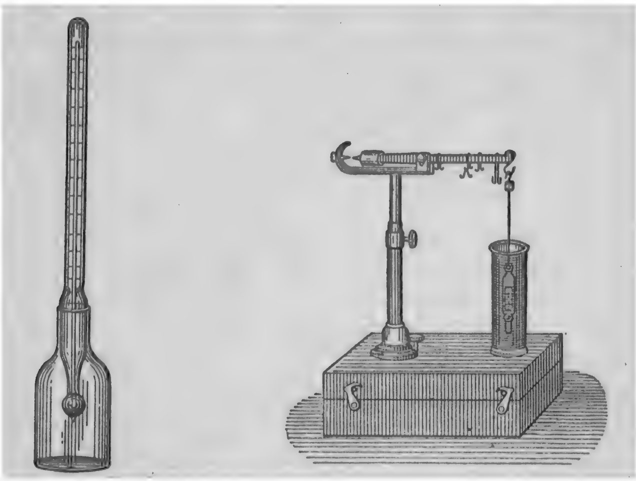


FIG. 9. Picnometer. FIG. 10. Specific gravity balance.

principle upon which the areometer works is that a heavy but floating body will sink the deeper in a liquid the lighter and less dense the latter is. Thus an areometer will not sink as far in a cold liquid as it will in the same liquid warmed. Hence the temperature must be accurately observed, and the liquid must be brought to a standard temperature, or else use must be made of the so-called correction tables. Areometers are used for the most varied purposes, and differ from each other by the scale division being adapted for the individual purpose. Characteristic for each is the fact that it gives the specific gravity directly, in that tables of dissolved or soluble substances are constructed showing the quantity of dissolved substance present and corresponding to a definite specific gravity. For technical purposes the scales are suitably divided to this end. Thus there are special

areometers for alcohol, acids, lyes, beer, milk, sugar, etc. For fruit juices, wines and mashes in particular, the so-called must gauge is used, this being divided into Oechsle degrees; these express the three first decimals of the specific gravity, leaving off the number 1 and the zero following the period: thus the expression 24° Oechsle indicates a specific gravity of 1.024 at 15° C. As a correction, 0.2° Oechsle is to be added for every degree above 15° C., and 0.2° is to be deducted for every degree below 15° C. Besides the normal scales, there are also those bearing the names of the authors by whom they were devised; thus those of Beck, Cartier and Baumé are still often met with. All these arbitrary scales, however, may be readily reduced to read in terms of specific gravity by means of comparative tables

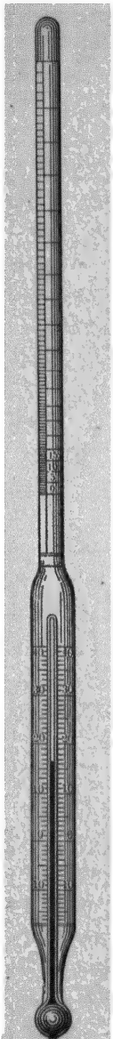


FIG. 11. Areometer.

The *areopicnometer*, Fig. 12, is a variety of areometer in which the lower end constitutes a bulb which is to be filled with the liquid to be tested, and the instrument is then to be floated in water at 15° C., when the specific gravity is read off by means of the division on the stem. To afford a more correct reading, it is advisable not to employ a general areometer with a scale adapted for all cases, but to employ a special areometer for each case, because thus the range of degrees is materially restricted, and the reading is rendered far more accurate.

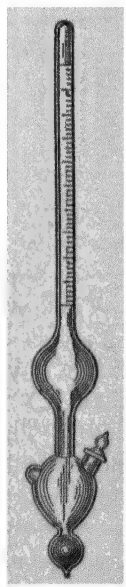


FIG. 12. Areopicnometer.

One of the most important determinations for the alcohol industry is the determination of the alcohol by means of a areometer designated as an *alcoholometer*. In this instrument the range between the specific gravity of absolute alcohol, 0.79425, and that of water, is divided into degrees. By proper division of the scale, the latter can be made to show the percentage strength

by weight and by volume of alcohol in a hydroalcoholic mixture. There may also be read the number of grams of alcohol contained in 100 cc. of the liquid. Comparative tables regarding alcohol values are in the hands of all distillers. By means also of an alcoholometer, or even of the specific gravity balance, and utilizing the tables, recalculations may be made or read off at any time to ascertain the alcoholic percentage by volume or weight, or to find the weight of a liter of the alcoholic liquid, or the number of grams of alcohol in 100 cc. of liquid. The recalculation of the number of grams of alcohol in 100 cc. in percentage by volume is made by multiplying the number of grams by 1.26. The number of grams alcohol in 100 cc. is usually used for low-percentage alcoholic liquids, as for instance, wine. Thus, if 8.5 gm. alcohol are present in 100 cc. wine, then $8.5 \times 1.26 = 10.71$, = the percentage by volume. Conversely, the percentage by volume is to be divided by 1.26 in order to ascertain the number of grams of alcohol in 100 cc. of liquid. The alcoholometer giving the percentage by weight, and the Richter scale, are chiefly used officially, at least abroad on the continent, while in practice the volumetric scale is usually preferred. As already stated, the percentage by weight shows how many parts by weight of absolute alcohol are contained in 100 parts of the liquid being examined, whereas the percentage by volume gives the same results in volumes instead of weights. From the specific gravity the weight of a given number of liters may be calculated. As in all these calculations the temperature plays quite an important rôle, it is usual to provide the alcoholometers with a table of corrections, showing how many degrees are to be added to those found when the temperature is above the normal, or how many are to be subtracted when the temperature is subnormal. The specific data are given in the well-known tables. In English-speaking countries the "proof spirit" is taken as the standard, and hence all practical data regarding alcoholic strengths in this volume are given according to Sykes' alcoholometer. This shows the percentage by volume of alcohol contained in a liquid and expressed as "proof spirit," which is assumed to be 57.27% by volume = 0.9186 specific gravity. Thus 10° overproof means that the alcohol is of $57.27 + 10 = 67.27\%$ volume strength, while 15° underproof would show that the liquid is of $57.27 - 15 = 42.27\%$ by volume strength.

The reading of the specific gravity simply shows the specific

gravity of the liquid as the latter is. Thus an alcoholometer will not show the alcoholic strength of a liquid which contains extract in solution, because the extract present vitiates the reading. The determination in such a case is carried out by distilling the liquid in question, and then determining the alcohol in the distillate.

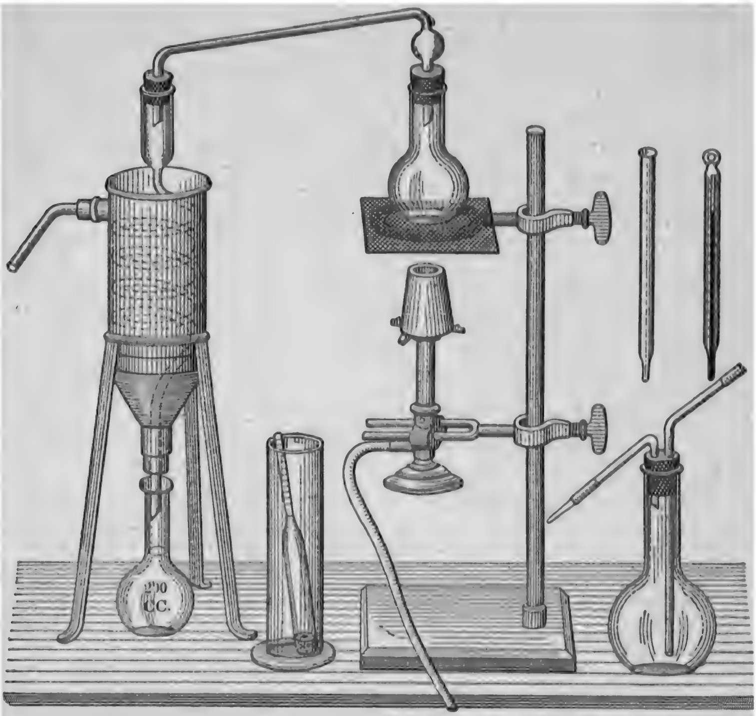


FIG. 13. Apparatus for determining the alcohol content in distillates.

For this purpose, a definite volume of the liquid being investigated is mixed with an equal volume of water, and distilled until the volume of distillate is the same as that of the liquid originally taken; in this distillate, then, the alcohol content is ascertained by means of the alcoholometer. In many cases it is desirable to determine the specific gravity of the alcoholic liquid itself as also that of its distillate which has been made up to the original volume, and that of the non-alcoholic distillation residue, from which conclusions may be drawn regarding the extract content by means of the so-called extract balance. Thus

if we designate the specific gravity of the liquid by a, that of the distillate by b, and that of the nonalcoholic distillation residue by c, then, by employing the so-called Tabaries formula, we can calculate a third unknown value from two known values, as $1 + a = b + c$, or also

$$a = b + c - 1,$$
$$b = 1 + a - c,$$
$$c = 1 + a - b.$$

On mixing alcohol and water, a characteristic *contraction* in volume takes place; that is, the volume of the total liquid is not equal to the sum of the two volumes mixed. Thus on mixing a liter of absolute alcohol with 99.055 liters of water there will be obtained exactly 100 liters of liquid containing exactly 1% alcohol by volume; hence a liter of alcohol has taken up 0.055 liter water without any increase in its volume. The degree of contraction varies according to the strength of the alcohol, and attains its maximum at 3.722% at a strength of 3° underproof, and whereas it increases to this maximum from zero alcoholic per cent, it decreases again up to absolute alcohol. In practice, on compounding alcohols an addition of 2.5% is calculated upon the average, and in compounding alcoholic liquids the individual ingredients must hence be taken into consideration so that to obtain 10 gallons of final products the calculations must be based on 10¼ gallons.

4. Extractive Determination

The extractives consist, as is well known, of the most varied substances which were originally present in solution in the plant juice. On drying, the solvent fluids are partially evaporated, but not completely, and in this case we speak of the substances as *air dried*. If these substances are subjected for some time to a heat of 212° F. until they cease to lose weight, they lose the remainder of the moisture. On this procedure is based the *moisture* determination of dry substances. In liquids, the extract can be determined by three methods, of which the most accurate is naturally that by the gravimetric method. In this method the specific gravity is first taken, and then 50 cc. of the liquid are evaporated on the water-bath until the extract is no longer fluid, whereupon it is dried to constant weight in a suitable drying oven, the temperature of which must not greatly exceed 212° F. The weight of

the dish (previously taken when empty) deducted from the total weight gives the net weight of the extract from 50 cc. of the liquid, and the proper calculations may then be made for the percentage by weight or volume.

The indirect extract determination is made by calculation from the specific gravity, the process being performed by taking 100 cc. of the liquid and distilling off any alcohol it may contain, and then adding distilled water to the distillation residue to make up to the original 100 cc. at the temperature of 15° C. The distillate is likewise made to measure 100 cc. by the addition of distilled water. If now we designate the original specific gravity of the liquid as O, the specific gravity of the alcoholic distillate as D and the specific gravity of the diluted distillation residue as X, then

$$X = 1 + O - D;$$

and the extract content will be found according to the formula

$$E = 2400 + (O - D).$$

When the difference between the specific gravity of the liquid being investigated and that of the distillate is, for instance, 0.01, then the liquid will contain 2.4% by volume extractive.

The third method of determining the extractive is that best adapted for ordinary practice. It requires no chemical balance, and still affords quite exact results. It requires the use of an extract balance, a form of areometer. In this case also the alcohol of alcoholic liquids must be distilled off and the residue made up to its original volume. All the measurements must, of course, be made at the normal temperature of 15° C. Below 15° C., 0.05% must be deducted for every degree of difference, and for every degree above 15° C. 0.05% must be added.

In the analysis of wines and of various other beverages, we also speak of extractive residues, which are extracts of which certain constituents have been analytically determined, as, for instance, in speaking of the first extract residue in wine examination when the nonvolatile acids have been deducted. We also speak of a nonsaccharine or sugar-free extract when the sugar content has been determined by some other method.

Extractive determinations are also made in the case of drugs and other solids, thereby having reference to the solids soluble

in a given solvent. Thus the water-soluble extract of drugs is that portion that may be isolated by fully exhausting the drugs with water. Likewise, the resinous extractive or resin content constitute those constituents which are isolated from the raw material with the aid of strong alcohol. The oil content, too, is ascertained by exhausting the material with liquids in which the oils are soluble, as, for instance, petroleum ether. For this purpose, a portion of the air-dried material is fully extracted in a small Soxhlet apparatus on the water-bath, then the solvent is evaporated off on the water-bath, and the extract then dried at 212° C. and weighed.

In the case of some volatile oils a *distillation residue* determination is made, as, for instance, with the citrus oils, which contain wax, or with other oils, which contain resin, or, lastly, to determine the presence of nonvolatile substances, such as resin, oil, etc. In this case the oil is heated to constant weight.

Even the *ash determination* is to a certain extent an extractive determination, because it gives the content of mineral substances present in any preparation. The ash determination is made in a platinum dish which is exposed to the great heat afforded by a blast lamp, and the incineration is continued until a constant weight is obtained. The difference in weight between that of the dish alone and that of the dish plus its contents gives the ash content of the substance. In the case of liquids, 100 cc. are usually evaporated on the water-bath to extract-like consistency, and when this has been fully dried it is weighed, and then incinerated. An additional test is usually made by leaching the ash with warm water and then determining the *alkalinity* by titration. By the alkalinity of the ash is understood the number of cubic centimeters of normal hydrochloric acid required to neutralize the ash from 100 cc. of liquid. The ash determination allows conclusions to be made regarding the quantities of the raw materials to be employed, for instance in making fruit juices or fruit beverages. In the tables on fruit juices we find the average content of mineral substances (ash content) stated. Any notably large deviation from these figures would point to the proper improvement to be made. The value of the mineral constituent depends mostly upon the content of alkali salts, and hence the alkalinity determination may also afford comparatively important conclusions.

5. Acidimetry (Titration Methods)

(a) *Determination of Acids*

Volumetric analysis comprises a number of methods in which certain chemicals are made to react, the end of such reaction being made evident to the eye by means of the so-called indicators. The most important determination, so far as concerns us, is that known as acidimetry, or acid determination. Comparable with this is alkalimetry, or alkali determination, which is in fact only a reversed acidimetry. The principle upon which both of these is based is that on the action of an alkali upon any acid a salt is formed, the end of the reaction being shown by an indicator. For instance, litmus, the most commonly used indicator, is reddened by acids, while alkalies change its color to blue. In the former case the reaction is said to be acid, in the latter, alkaline. By the reaction between an acid and an alkali, a so-called neutral salt is formed, which is made evident by the violet color of the litmus. This color is changed to a distinct red by the slightest excess of acid, and to blue by the least excess of alkali, and hence where an acid and an alkali react in the presence of litmus, the latter indicates the end of the reaction by the neutral violet color. Litmus paper in strips may be employed in this case. Still more distinct is the reaction when phenolphthalein is used. The phenolphthalein is dissolved in alcohol, and a few drops are added to the liquid being tested. Acids have no action on it, but the slightest excess of alkali is indicated by the development of a deep-red color; on the other hand, in alkaline liquids which have been reddened by phenolphthalein, the color is discharged by the slightest excess of acid.

According to the principles of chemical equations a given quantity of an acid or alkali always requires a constantly definite quantity of alkali or acid for combination, and when the quantity of one is known, the quantity of the other may readily be calculated. For our purposes, *normal potassium hydroxide solution* is used for determining acids, the alkali solution containing 56 gm. potassium hydroxide (KOH) per liter at 15° C. Every cubic centimeter of this solution hence contains 0.056 gm. KOH. For determining alkalies, *normal hydrochloric acid* is employed, each liter of which contains 36.5 gm. chemically pure hydrochloric acid (HCl) at 15° C. Each cubic centimeter hence contains

0.0365 gm. HCl. 1 cc. each of the normal alkali and normal acid solutions can combine to form a neutral salt.

Titration is effected by means of burettes which are provided with cocks easily closed, whereby the instruments may be emptied drop by drop. Burettes are usually made to hold 50 cc., and bear scales divided into tenths of a cubic centimeter. In practice it is best to have two such burettes mounted on a suitable stand, as here shown, one being filled with the normal acid, the other with the normal alkali. The titration is effected in suitable beakers, usually 5 to 10 cc. of the liquid to be investigated being taken and suitably diluted with water, the more freely if the liquid is colored. A few drops of phenolphthalein solution are then added. If the liquid is acid, no color change occurs; if alkaline, however, it acquires a red color. In determining acids, then, the point at which the alkali solution stands in the burette is read and noted down, and then the alkali solution is allowed to drop into the acid, while constantly stirring, until the liquid is colored a distinct red, which does not disappear even on frequent stirring. Another burette reading is now taken, and the difference between the two readings gives the number of cubic centimeters of normal alkali solution that were required to neutralize the 5 or 10 cc. of the liquid under investigation.

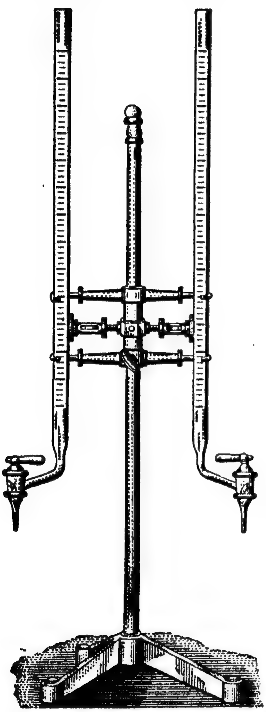


FIG. 14. Titration apparatus.

The recalculation to acid is usually for the calculation of the so-called fruit acids, as tartaric, malic and citric acids; for volatile acids, as acetic acid; and for certain fermentation products, like beer, as lactic acid. Each cubic centimeter of normal alkali used up corresponds to 0.075 gm. tartaric acid, or 0.060 gm. acetic acid, or 0.090 gm. lactic acid, or 0.067 gm. malic acid, or 0.064 gm. citric acid.

The number of cubic centimeters of alkali solution used up, as above ascertained, is multiplied by the coefficient of the respec-

tive acid, and the result gives the quantity of acid in grams contained in the 5 or 10 cc. of liquid; by then multiplying by 20, or by 10, as the case may be, the number of grams acid in 100 cc. of liquid are then found. By taking the specific gravity of the original liquid also into account in the calculation, the percentage content by weight may also be ascertained. It is usual, however, in analyses to state only the content in 100 cc., and the figure for the acid so obtained comprises the total acid, and not the individual figure for a definite acid. In analyses, the total acid is given for wines as tartaric acid; for fruits, as malic or citric acids; and for alcoholic liquids, as acetic acid.

A part of the acids occurring in the substance which interest us, consist of *volatile acids, i.e.*, such as are distillable, and which pass over into the distillate. In this case it is necessary to mix 100 cc. of the liquid with an equal volume of water, and then to distil off exactly 100 cc. In the distillate so obtained the acid content is then ascertained in the usual way by titration, and in all cases calculated as acetic acid. The quantity of volatile acid so found is then to be deducted from the *total acid* found, and the difference gives the *fixed* or *nonvolatile* acid; it is customary to give both figures in analyses. When liquids containing carbon dioxide are to be titrated, the carbon dioxide must first be driven off by heating. When very small quantities of acid are to be determined, it is customary, for the sake of greater accuracy, to dilute the alkali solution to halfnormal, or even decinormal, in which case the figures for the corresponding acids must be correspondingly reduced.

(b) *Determination of Esters; Acetylization*

Titration methods are also of great importance in the *determination of the ester content* of various volatile oils, and particularly for ethers. The methods are employed especially for oils of bergamot, lavender and peppermint. The value of bergamot and lavender oils depends upon the linalyl acetate content; and in peppermint oil, the esterified menthol is to be determined. The procedure is about as follows: From 1.5 to 2 gm. of the oil are accurately weighed off into a wide-mouthed flask of about 100 cc. capacity; the oil is then diluted with alcohol, some phenolphthalein solution added, and the free acid present then titrated, for which purpose halfnormal potassium hydroxide solution is used.

The result gives the acid number, which expresses the number of milligrams of KOH that were required to neutralize the free acid present in 1 gm. of the oil. Thereupon 10 to 20 cc. halfnormal potassium hydroxide solution are added, and the mixture is heated for one hour on the water-bath under a reflux condenser. When cool, 50 cc. water are added to the contents of the flask and the excess of potassium hydroxide is titrated back with halfnormal hydrochloric acid. The difference between the cubic centimeter of halfnormal alkali and halfnormal acid solutions gives the total alkali required for saponification, and from this we obtain the *ester number,* which expresses the number of milligrams of KOH required to saponify the ester present in 1 gm. of the oil. To calculate the acid number or ester number use is made of the following formula:

$$\frac{28 \times \text{cc. } \frac{n}{2} \text{ alkali used}}{\text{No. of gm. of oil}}.$$

The sum of the acid number and the ester number is designated as the *saponification number.* The percentage content of ester is calculated according to the following formula:

$$\frac{\text{Molecular Weight of Ester} \times \text{Ester Number}}{560} = \text{Ester percentage.}$$

For instance, the molecular weight of linalyl acetate is 196, and of menthyl acetate (in peppermint oil) 156. The molecular weights of the more usual esters will be found in the table of esters. On the other hand, however, the alcohols, which are present in volatile oils, may also be calculated, since they may be esterified by means of acetic acid. This is termed *acetylization.* From the ester number of the acetylized oil the alcohol content can then be calculated. The acetylization is effected as follows: 10 to 20 cc. of the oil are boiled for one hour with an equal volume of glacial acetic acid and 1 to 2 gm. anhydrous sodium acetate under a reflux condenser. The mixture is then allowed to cool, an equal volume of water is added, and the whole heated on the water-bath for 10 minutes in order to decompose the excess of acetic anhydride. The mixture is then allowed to cool again, and is transferred to a separatory funnel whereby the oil is separated from the aqueous liquid, and is washed with water until neutral in reaction. The oil is next dehydrated by treatment with anhydrous sodium sul-

phate, and 1.5 to 2 gm. of the dried oil are then taken for the determination of the ester number as above, after the free acid present has been first carefully titrated.

If now we designate the number of cubic centimeters of half-normal potassium hydroxide solution used up as a, and the quantity of the acetylated oil taken for saponification as s, then the quantity of alcohol originally contained in the oil is ascertained by the equations which follow, and which are given for the oils most used. The quotient for menthol is 7.8; for geraniol (in rose oil) 7.7; for anethol (in anise oil and star anise oil) 8.8; and for santal oil (in sandal wood) 11. The equation is:

$$\text{Percentage Alcohol} = \frac{a \times (\text{quotient as above})}{s - a \times 0.021}.$$

6. Shaking-out Methods

(a) *Determining Higher Alcohols (Fusel Oil) in Liquor*

The liquor to be tested must first be freed from coloring and extractive matters, hence a distillate is used. The alcoholic content of the liquor must also be determined in advance. In order to free the liquor from coloring, extractives and esters, 100 cc. are mixed with 10 cc. of normal potassium hydroxide solution, and sufficient distilled off to measure exactly 100 cc. at 15° C. The distillate is now carefully reduced to a 30% by volume strength. Should it contain less alcohol than 30% by volume, it must be brought to this strength by the addition of pure absolute alcohol. In this case the strength is once more controlled with the greatest care by means of the alcoholometer so as to be fully up to the mark. For carrying out the test a shaking-out apparatus is employed, Fig. 15, the lower portion of which has a capacity of 20 to 25 cc., and bears a scale divided in tenths of a cubic centimeter. Pure chloroform is first introduced up to the 20 cc. mark, and then 100 cc. of the diluted alcohol are introduced, followed by 1 cc. of pure sulphuric acid (sp. gr. 1.2857 = about 37.4%); the liquids are then mixed for about 15 minutes by repeated inversion of the apparatus so that the liquids may commingle and pass each other without, however, forming a difficultly separable emulsion. The apparatus is then allowed to stand in order to permit the liquids to separate, and after the temperature of the liquids has been brought to 15° C., the chloroform volume

is read off, as the chloroform will have taken up all the higher alcohols present.

The same procedure is gone through once more, but this time using absolute alcohol which has been brought to a 30% by volume strength by the addition of water. The content of higher alcohols may then be calculated. The chloroform reading of the liquid investigated may be designated as a, and that using diluted alcohol, made from absolute alcohol as a control, may be designated as b; the equations will then be as follows:

1. Calculated for 30% by volume alcohol,

$$6.631 \times (a - b) = \text{volume per } 1000.$$

2. Calculated for 100% alcohol,

$$22.103 \times (a - b) = \text{volume per } 1000.$$

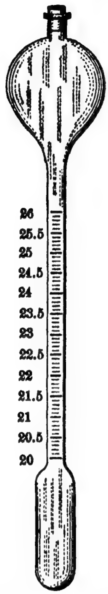


FIG. 15. Apparatus for shaking-out in fusel-oil determination.

(b) *Determination of Aldehydes in Volatile Oils*

For this there is usually used the so-called cassia flask, so named because it is generally employed for cassia oil. The flask has a capacity of about 100 cc. The long neck is about 8 mm. in diameter internally, and holds over 6 cc., while it bears a scale divided in tenths of a cubic centimeter. The zero point is a little above the part where the flask proper merges into the neck. 10 cc. of the oil to be tested, together with 10 cc. of a 30% solution of sodium bisulphite, are heated on the water-bath with frequent shaking until the coagulum first formed has liquefied. More bisulphite solution is then added gradually, with continued heating and frequent shaking, until all solid particles have disappeared and the supernatant oil is absolutely clear. After the mixture has been allowed to cool, more bisulphite solution is added so as to bring the oil into the neck of the flask, and then the volume of the oil is carefully read. The number of cubic centimeters of non-aldehydic constituents (*i.e.*, the separated oil) is now deducted from 10, and the difference gives the aldehyde content; by multiplying this difference by 10, the percentage content is obtained.

(c) *Phenol Determination*

This is also carried out in a cassia flask. 10 cc. of the oil, *e.g.*, clove oil, are shaken for several minutes with a 5% solution sodium hydroxide whereby the phenol present in the oil is converted into a soluble phenol salt, whereas the nonphenols remain undissolved, and on standing collect on the surface of the liquid. By now filling the flask and bringing the nonphenols into the graduated neck, the quantity of the latter present is read off. From the difference the phenol content is ascertained directly.

7. Sugar Determination

The sugar content of aqueous liquids consisting exclusively of sugar and water is ascertained by the specific gravity. Most saccharin liquids, such as wine, liqueurs and nonalcoholic beverages, contain partly cane sugar, partly invert sugar. Fermented liquids, such as wine, generally contain invert sugar. In order to determine both sugars, two tests must be made. The invert sugar is directly determined, whereas any cane sugar present is first converted into invert sugar and then determined as such. 100 parts by weight of cane sugar on taking up water yield 105 parts by weight of invert sugar. The determination is made as follows:

(a) *Determining Invert Sugar*

A 50-cc. burette graduated in tenths of a cubic centimeter is filled with the liquid to be examined. A solution of Rochelle salt is now made by dissolving 173 gm. pure Rochelle salt in 400 cc. distilled water, adding 100 gm. of a sodium hydroxide solution (containing 516 gm. NaOH per 1000 cc.), and then adding water to make the whole measure 500 cc. Next a solution is made by dissolving 34.639 gm. crystallized cupric sulphate in distilled water to make 500 cc. Now 5 cc. of each of the Rochelle salt and copper sulphate solutions are placed in a porcelain dish, a little water is added, and the mixture is heated to boiling, whereupon the liquid in the burette is allowed to run in while stirring constantly with a glass rod, the liquid being kept briskly boiling. The Fehling's solution — by which name the Rochelle salt-cupric sulphate mixture is known — originally has a fine blue color, and this color persists if the liquid being examined contains no invert

sugar. If, despite the boiling, and the frequent addition of the liquid being examined, no change of color takes place, the invert sugar content may be placed at zero, but if the latter is present, the initial addition will develop a change in color, the blue passing gradually into green and finally into a reddish The liquid is allowed to run in a little at a time, while maintaining the boiling and stirring, and the test is considered to be at an end when the blue color has fully disappeared. This moment is rather difficult to determine, hence chemical means are resorted to for ascertaining it. A piece of white filtering paper is folded several times, and when the test is considered to be at an end, a drop of the liquid from the dish is placed on the paper. The drop filters through and shows a colorless, moist spot on the reverse side of the paper. This spot is then touched with a drop of acetic acid followed by a drop of potassium ferrocyanide solution; if a red color develops, the determination is still incomplete, and it must be continued until no red color reaction is obtained. If now the figure 5 be divided by the number of cubic centimeters of the liquid being investigated, the quantity of invert sugar in grams present in 100 cc. is obtained. Thus were 32.6 cc. of the examined liquid required, 100 cc. of it would contain 5 : 32.6, = 0.153 gm. invert sugar.

The method is applicable only when the content of invert sugar is very small, in fact not greater than 0.5 gm. per 100 cc. Where a greater quantity is present, the liquid must be diluted, sometimes even 50 or 100 times, in fact, and then of course making the proper correction for the dilution.

(b) *Determining Cane Sugar*

50 cc. of the liquid to be examined are heated with 5 cc. of a 1% hydrochloric acid for half an hour on the water-bath, whereby the cane sugar is converted into invert sugar. The hydrochloric acid is then neutralized with potassium hydroxide solution, and the liquid is then made up to 100 cc. by adding distilled water. The determination of the invert sugar is then made in this solution, as above, only in this case instead of the figure 5, the figure 10 must be taken, because of the dilution to double the volume. In this case, too, where the sugar content is high, the proper dilution must be made, as before.

The calculation is now made as follows: The invert sugar is

first determined in a sugar solution, and then in another portion the total sugar, *i.e.*, not only the invert sugar, but also the cane sugar which has been converted into invert sugar. The difference between the two determinations gives the cane-sugar content.

8. Investigating Potable Waters

Water is an important constituent in the manufacture of mineral waters and lemonades, and hence special care must be taken regarding its purity. First of all, it must be clear, colorless and odorless. Any residue left on evaporation must be colorless. When kept in closed vessels which however admit air, no turbidity should occur, nor should there be any precipitation of greenish or brownish organic matter. Water must not contain any decomposition organisms. Of organic matter it must not contain more per liter than will be oxidized by 10 cc. of permanganate solution, the determination being carried out as follows: 100 cc. of the water are mixed with 5 cc. diluted sulphuric acid and 10 cc. of potassium permanganate solution (0.32 gm. per liter), and the mixture is boiled. The excess of permanganate is then titrated with oxalic acid solution (0.63 gm. per liter). Each gram of potassium permanganate used up is considered to be equivalent to 5 gm. of organic matter.

On boiling water with an ammoniacal silver nitrate solution no turbidity must develop. A liter of water must not contain more than 0.0001 gm. ammonia. The detection of the latter is effected by means of Nessler's reagent (a mercury and potassium iodide solution containing caustic alkali). To 200 cc. of the water there are added a few drops of sodium hydroxide solution and 2 cc. sodium carbonate solution, which effect the precipitation of calcium and magnesium carbonates. After decanting from the deposit, 100 cc. of the liquid are mixed with 1 cc. of the Nessler's solution. If the water contains ammonia, a yellow color develops, and if much is present a yellow to reddish precipitate forms.

A liter of water should not contain more than 0.01 gm. *nitric acid*, or 0.02 gm. *chlorine*. The nitric acid is detected by means of a solution of a few crystals of diphenylamine in 3 cc. concentrated sulphuric acid; on adding 1 cc. of the water to this solution, the mixture acquires a blue color if nitric acid is present. The chlorine is determined as follows: Add 3 drops of neutral potassium chromate solution to 50 cc. water, and titrate with decinormal

silver nitrate solution to permanent redness. By multiplying the number of cubic centimeters of silver nitrate solution used up by 0.071, the quantity of chlorine per liter expressed in grams is obtained.

Nitrous and *phosphoric acids* must not be present in potable water. Nitrous acid is detected by treating 200 cc. of the water with 2 cc. of pure diluted sulphuric acid and a few cubic centimeters of zinc iodide-starch solution. If any nitrous acid is present, a blue color develops, as the acid liberates iodine from the zinc iodide, and the iodine then reacts with the starch. The phosphoric acid is determined as follows: 2 cc. purest nitric acid are added to 100 cc. of the water, and the mixture is then evaporated to dryness. The residue is dissolved in hot distilled water acidulated with nitric acid, the solution filtered, and the filtrate while still warm, treated with a warm solution of ammonium molybdate in nitric acid. If any phosphoric acid is present, a yellow precipitate forms. Tests for *sulphuric acid* must also be made, by acidulating 500 cc. of the water with a few drops hydrochloric acid and adding barium chloride solution, when barium sulphate will be precipitated. The mixture is then filtered, and the precipitate washed, dried and ignited. The weight of the barium sulphate so obtained when multiplied by 0.3433 gives the quantity of sulphuric acid present in the 500 cc. water. The determination of the *hardness* of the water gives the quantity of the calcium and magnesium salts causing such hardness. We speak of a *total hardness*, *i.e.*, that of the unboiled water, and *permanent* hardness, *i.e.*, that of water boiled for half an hour and then made up to the original volume with distilled water. Hardness is determined by means of a soap solution, which precipitates the alkaline earths in the form of insoluble fatty compounds. The soap solution is standardized against a barium chloride solution (0.523 gm. of the crystallized salt per liter). 100 cc. of this solution should require for decomposition 45 cc. of the soap solution added gradually, and with thorough shaking after each addition. While any undecomposed barium chloride is present, no foam develops, but the moment free sodium oleate, *e.g.*, soap, is present undecomposed, foaming occurs. For saturating 0.012 gm. of lime, as CaO, 45 cc. of soap solution are required, and this corresponds to 12° of hardness. For determining the hardness, 25 cc. of the water to be examined are introduced

into a 200-cc. glass cylinder, and then distilled water is added to make 100 cc. From a burette soap solution is now allowed to run in cautiously, and with frequent vigorous shaking, until a permanent, heavy foam persists. The following table is used for determining the hardness, the quantity of soap solution required for 100 cc. of the water serving as the basis:

Soap solution.	Degree of hardness.	Soap solution.	Degree of hardness.
cc.		cc.	
3.4	0.5	28.0	7
5.4	1.0	31.6	8
9.4	2	35.0	9
13.2	3	38.4	10
17.0	4	41.8	11
20.8	5	45.0	12
24.4	6	....	....

Both the *total hardness* and the *permanent* hardness (that remaining after the water has been boiled) are determined, and the difference between the two determinations gives the temporary hardness. The total hardness should not exceed 20°. The German degree of hardness is based upon the unit of lime, CaO, or its equivalent quantity of magnesia, MgO, present in 100,000 parts of water, while the French standard is the unit of calcium carbonate, $CaCO_3$, present in 100,000 parts of water. Finally, the total residue is determined by evaporating a given volume of water to dryness; it should not exceed 0.5 gm. per liter.

9. The Most Important Reactions of Chemicals

The most important reactions, so far as they concern this work, and are of importance to the manufacturer, are here given. In the testing of chemicals we have to distinguish between the tests for the identity of the substance under investigation and the detection of impurities which may militate against the use of the chemical. The reactions which permit of the identification consist in the mutual action upon each other of chemicals, the result being usually a white or more or less colored precipitate, or a coloration; the precipitates also differ from each other in being soluble in other and different chemicals. Frequently they dissolve in an excess of the reagent. Thus the fixed caustic alkalies precipitate aluminum hydroxide from aluminum salts, but the

precipitate dissolves in an excess of the precipitant. On the other hand, ammonia water causes a similar precipitate, but in this case the precipitate does not redissolve in an excess of ammonia water. Very often the precipitate may be identified by its solubility or otherwise in various chemicals, and lastly a precipitate may form only in the presence of, or its formation may be even hindered by, other chemicals. One of the simplest tests is the flame test, as different compounds impart characteristic colors to a nonluminous flame.

(a) *Alkali Metals*

Potassium: With this platinic chloride gives a yellow crystalline precipitate (difference from sodium). Tartaric acid, in the presence of alcohol, gives rise to a crystalline precipitate of potassium bitartrate. The nonluminous flame is colored a bright violet.

Sodium: Dipotassium pyroantimonate develops a white precipitate in not too dilute solutions containing sodium; all other sodium compounds are soluble. The flame is colored intense yellow.

Lithium: The flame is colored carmine red.

Ammonia and *Ammonium Salts:* A brown color with Nessler's reagent. All ammonium salts are volatilized by heat, and from them gaseous ammonia is liberated by the alkali hydroxides, the liberated ammonia being detected by the odor and by its coloring turmeric paper brown.

(b) *Earthy Alkalies*

Calcium: Ammonium oxalate develops, even in the most dilute solution, a white precipitate insoluble in acetic or oxalic acid (with barium and strontium a similar precipitate, but only in concentrated solutions). The flame is colored yellowish-red.

Barium: With sulphuric acid a white, and with potassium dichromate a yellow, precipitate (strontium and calcium afford no precipitate with chromates). The flame is colored green.

Strontium: Affords a white precipitate with sulphuric acid. The flame color is red.

Magnesium: In the presence of sufficient ammonium salts, magnesium salts are precipitated by the alkali carbonates or hydroxides, or by ammonia. A mixture of sodium phosphate solution and ammonia water precipitates magnesium salts, even in

the presence of ammonium salts, as white crystalline ammonium magnesium phosphate.

Aluminum: Ammonia water and ammonium sulphide precipitate aluminum hydroxide insoluble in an excess of the precipitant. Caustic alkalies precipitate gelatinous hydroxide, easily soluble in an excess of the precipitant.

(c) *Heavy Metals*

Copper: Ammonia gives a greenish-blue precipitate soluble in excess of ammonia water. Iron and zinc precipitate the metal on their surface.

Iron: Ammonium sulphide develops a black precipitate easily soluble in acids. Potassium ferrocyanide gives with ferrous salts a white precipitate rapidly becoming blue; with ferric salts it gives a deep blue precipitate. Potassium ferricyanide gives with ferrous salts a blue, and with ferric salts a reddish-brown, precipitate. Tannin gives with ferrous salts no coloration, but with ferric salts a black, inky precipitate.

Lead: Gives with hydrogen sulphide a black precipitate insoluble in alkalies; with caustic alkalies a white precipitate soluble in excess of precipitant; and with sulphuric acid a white precipitate soluble in caustic alkali solution.

Tin: With hydrogen sulphide the stannous salts afford a brown, and with stannic salts a yellow, precipitate, soluble in ammonium sulphide solution, from which solution, however, it is again separated as a yellow precipitate.

Zinc: Gives with ammonium sulphide a white precipitate insoluble in acetic acid, but soluble in dilute mineral acids; with caustic alkalies or ammonia, a white precipitate soluble in excess of precipitant.

Manganese: Gives with ammonium sulphide a flesh-colored precipitate.

Nickel: Gives with ammonium sulphide a black precipitate insoluble in hydrochloric acid; with caustic alkalies a green, and with ammonia a greenish, precipitate, soluble in excess of precipitant with blue color.

(d) *Reactions of Acids*

Hydrochloric Acid: Gives with silver nitrate a caseous, white precipitate soluble in ammonia, but insoluble in nitric acid.

Sulphuric Acid: Gives with barium and lead salts a white precipitate insoluble in acids.

Bromine Compounds: With silver nitrate a yellowish-white precipitate soluble in ammonia. On shaking with chlorine water, bromine is liberated, which colors chloroform brown.

Iodine Compounds: With silver nitrate a yellow precipitate soluble in ammonia. On shaking with chlorine water, iodine is liberated, which colors chloroform violet, and starch paste blue.

Fluorine Compounds: When heated with sulphuric acid the vapors evolved etch glass.

Carbon Dioxide: Becomes evident on adding sulphuric acid to a carbonate. On passing the evolved gas into lime-water, the latter becomes turbid, due to the precipitation of calcium carbonate.

Nitric Acid: A colorless solution of diphenylamine in sulphuric acid is colored deep blue even by traces of nitric acid; the coloration is also afforded, however, by nitrous acid. On floating a solution of ferrous sulphate on a mixture of concentrated sulphuric acid with a nitrate solution, a dark-brown zone forms at the junction of the two layers of liquid.

Arsenic Trioxide: The detection is based upon the conversion into arsenic hydride, which, when ignited, deposits metallic arsenic in the form of the so-called arsenic mirror.

Boric Acid: When treated with sulphuric acid affords a green flame reaction. The alkaline borates color turmeric paper an immediate brown, while acids change the brown color into yellow again.

(*e*) *Organic Acids*

Hydrocyanic Acid: The liquid to be tested is first treated with some caustic alkali (KOH) solution, then some ferric and ferrous salt is added, the mixture being then heated and acidulated; if hydrocyanic acid is present, potassium ferrocyanide forms, which gives with the ferric salt a deep blue precipitate, although when only a very small quantity is present only a blue coloration develops at first.

Fruit Acids: Malic Acid gives with lead salts a white precipitate.

Tartaric Acid gives with potassium salts in the presence of alcohol a crystalline precipitate of potassium bitartrate; if neutralized with lime-water, the calcium tartrate formed remains in solution. On the other hand, lime-water affords with *citric*

acid calcium citrate which is soluble in cold, but insoluble in boiling, water, and by this means these two acids can be separated.

Benzoic Acid and its salts give a reddish-yellow precipitate with ferric chloride.

Salicylic Acid gives with ferric chloride a violet precipitate.

Formic Acid is identified by the fact that it has powerful reducing properties even in high dilution, the well-known silver mirror being thus made evident and utilized for the detection.

Detection of Saccharin: Frequently it is suspected that certain beverages have been sweetened with saccharin, where the use of the latter is forbidden. The following method of detection may be employed by the layman without undue difficulty: 100 cc. of the liquid are evaporated on the water-bath to about 5 cc., whereupon some coarse, washed sand is added. The residue is next treated with 2 cc. of 30% phosphoric acid solution, and the mixture then extracted by shaking with 20 cc. of a mixture of equal parts of ether and petroleum ether. The saccharin dissolves in this ether mixture, and, on evaporating the solvent, the residue may be identified as saccharin by its intensely sweet taste.

10. Colorimetry

The detection of tar dyes is frequently necessary in cases where products, which naturally have a color, have perhaps been artificially colored. In syrups and juices the tar dyes are detected by treating 10 cc. of the liquid with 10 drops of ammonia water and then shaking with 10 cc. of amyl alcohol. If any tar dyes are present, they pass into solution in the amyl alcohol which becomes colored. Tar dyes are usually detected by their staining action on woolen threads which have previously been mordanted with alum and sodium acetate. For this, 10 cc. of the liquid are boiled for ten minutes with 10 cc. of a 10% potassium sulphate solution, while the woolen threads are immersed; the threads are then removed and washed. The test is particularly used for red wines, and even though natural uncolored wines do slightly color wool, the coloration is not nearly as strong as that afforded by even traces of tar dyes. The wool threads are then washed with ammonia water; if any tar dye is present, the wool remains red, or it acquires a yellowish color which passes again into red when the ammonia is washed from the thread. Vegetable colors on treatment with ammonia pass into a dirty, greenish-white color.

The differentiation of the various plant coloring matters is exceedingly difficult, and it is only through extensive practice that the presence of any artificial organic dyes may be detected from the colors afforded by lead-acetate precipitates.

Caramel, or sugar coloring, is detected indirectly, in that the liquid to be investigated is first well diluted, then acidulated, and treated with solution of albumin, whereby all coloring matters, other than caramel, are precipitated; by now comparing the color of the filtrate, after filtering, with that of the liquid originally before precipitation, certain conclusions may be drawn regarding the presence of caramel if the liquid retains any color.

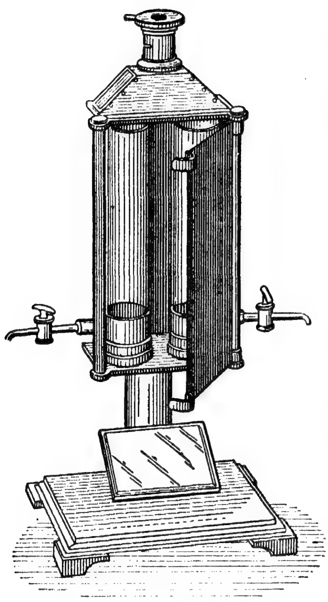


FIG. 16. Colorimeter.

The *comparison* of colors is of great importance to the practical man, particularly with regard to their colorific power and tints or shades of coloring. The differences in shade can be detected only by the trained eye, and the detection is rendered sharper by certain acids. All the solutions used in the determination, and which are prepared by weight and diluted volumetrically, are adapted for comparative purposes when sufficiently transparent, and the best results are afforded by observations made through the layers of liquids. The liquid to be tested is filled into a test-tube which is placed on a light-colored ground, and the liquid observed from above downward, the depth of the layer of liquid being then diminished or increased until the color observed agrees with that of the standard alongside. By comparing the height of the two columns of liquids the concentration of the sample may be approximately gauged. Quite accurate results may be obtained by means of the colorimeter (Fig. 16). This consists of two glass cylinders graduated alike, and both of which may be seen at one time by means of an eyepiece and properly adjusted prisms. One cylinder is filled to a certain mark with an accurately made normal color solution of known strength,

and in the other cylinder is introduced the liquid to be tested. This cylinder is fairly filled, and is provided with a small cock through which the liquid may escape slowly drop by drop. The color of the two columns is observed through the eye-piece, and the liquid to be tested is then allowed to escape until the color of the two columns of liquid matches. From the height of the column of liquid tested its coloring value may then be determined to a fraction.

Where it becomes a question of matching color shades, this can only be accomplished by empirical methods. The tar dyes here in question are all more or less mixed colors, and the dusting of some of the substance on a sheet of moist filter paper may afford some idea as to the dyes used, because of the varied solubility of the different substances. Even on filtering a solution, too, information may be gained, because of the distinct differences in the marginal colors observed, due to differences in diffusion. The reproduction of shades of colors otherwise is only possible to the experienced eye, whereby not only the colorific power and the color tint have to be considered, but also the uniformity of the coloring action at various dilutions. It is very often the case that two transparent color solutions appear to have identical colors, but when largely diluted exhibit unaccountable differences; or that two solutions which exhibit like colors when observed by transmitted light, across the column, show quite different results when observed from above downwards through the column.

The *decolorization* of liquids is of frequent occurrence in practice. For this purpose it is usual to employ charcoal (wood or bone), which has the property of decolorizing colored liquids, the coloring matter being retained in its pores. Charcoal has no action, however, on the so-called pigments, among which may be also classed the brown substances dissolved in the plant juices, as, for instance, the brown coloring matters of tinctures and extracts. Nor does it take up caramel. Nevertheless care must be exercised when using charcoal because it takes up flavoring substances to a noticeable extent, and may thereby impair the taste of a liquid. Charcoal, moreover, acts quite rapidly, so that its action need be allowed to continue but for a short time. The quantity of charcoal to be used is usually 0.5% of the weight of the liquid to be decolorized.

Bleaching by sunlight is also adapted for certain purposes, par-

ticularly for volatile oils, as in making anethol and menthol, where it is desired to obtain perfectly white, crystalline products. In the case of colors which are due to the presence of iron, as in the discoloration of liquors kept in stock, and the tannin of which has come into contact with iron, the decolorization may be effected by precipitating the coloring matter with milk, the coagulum of which carries the coloring matter down with it.

11. Testing by Sense of Taste, Smell, Etc.

It is most natural for the practical man to use the senses of smell and taste in making comparative tests, but tests of this kind cannot be as fully convincing as those afforded by practical reactions, and sufficient certainty of results can only be obtained by considerable practical experience. In the first place a comparison with a standard is absolutely necessary, and particular consideration must be directed to the fact that the sense may become tired or overstrained. Nor are such determinations uninfluenced by psychic conditions, so that a repetition of the test is usually necessary at various intervals of time.

It is important in carrying out sense tests that these be divided into definite possibilities. The odor development is most characteristic when judged in great dilution. In this, however, the odor of the substance, best observed by spontaneous evaporation from filter paper, must be noted from time to time, and particular attention must be paid to the odor which is last given off. The comparison of an odor by dilution with hot water, in order to render more evident the sensitive odors, is also advantageous, as is, in fact, any dilution. As, however, in compounded preparations the characteristic odor is frequently modified by other substances present, an attempt may be made to separate these, as, for instance, in acidulous liquids by neutralizing the acid. The odorous substances are most surely characterized when shaken out from liquids by means of, say, petroleum ether, in which almost all odorous substances are completely soluble, and from which, on evaporation, the odorous substance can best be judged.

The same is true of the taste. When the flavoring substance is present with an odorous substance, and volatilizes with the latter, it is equally advisable to shake out with petroleum ether, but the concentrate is allowed to evaporate from sugar and the flavoring thus isolated on the latter which, under certain circum-

stances in combination with some fruit acid, constitutes an excellent means of judging volatile flavors. On the other hand. extractives are best tested when they are first freed from volatile by-substances, and, so far as liquids are concerned, evaporating them to an extract-like consistency, the extract being then dissolved and the solution tested by tasting. Acids, which impair the taste, are to be neutralized with calcium carbonate, and an attempt should be made in every way to isolate the flavoring substance in order to identify it. In all cases, however, there should be no delay in resorting to exact analyses to confirm the findings afforded by the senses of smell and taste.

The *imitation* of flavoring substances can only in the rarest cases be based on a serviceable analysis, but more rather the results afforded by the senses of smell and taste come here in question. In order to obtain any degree of certainty, however, it is advisable to install an organoleptic collection, consisting of normal extracts of the raw materials in question, in the form of tinctures of known strength, or of solutions of known strength of volatile oils or odorous substances. It is then comparatively easy to make the preliminary practical tests based on the odor and taste of the substance examined as compared with those of the standard, of which comparatively small quantities are required, and from which the formula for the compound may finally be constructed.

PART IV

NON-ALCOHOLIC BEVERAGES

INTRODUCTION

I. The Mineral-Water Industry

The Quality of the Water.
Carbonic Acid.
Natural and Artificial Mineral Waters.
Mineral Water Salts and Their Preparation.
Normal Solutions of Salts for Mineral Waters.

A. Table Waters

1. Selters Water.
2. " " , Dr. Struve.
3. Soda Water.
4. Table Water "Cosmos."
5. Harzer Sauerbrunnen.
6. Selters Salt.
7. Table Water.
8. Sauerbrunnen Salt.
9. Appollinaris.
10. National Table Water.
11. Temperance Table Water.

B. Artificial Mineral Waters

1. Aix-la-Chapelle.
2. Apollinaris.
3. Baden-Baden.
4. Bilin, Josef-Spring.
5. Eger, Franzensbrunnen.
6. Emser Kraehnchen.
7. Fachingen.
8. Franzensbad.
9. Friedrichshall Bitterwater.
10. Harzer Sauerbrunnen.
11. Hunyadi-Janos.
12. Karlsbad, Muehlbrunnen.
13. Kissingen, Rakoczi.
14. Levico, Iron-Arsenic Spring.
15. Marienbad, Kreuzbrunnen.
16. Neuenahr, Sprudel.
17. Niederseltzer.
18. Pyrmont, Headspring.
19. Salzbrunn, Crownspring.
20. Salzschlirf, Bonifacius Spring.
21. Soden, Taunus, Warm Brunnen 3.
22. Spaa, Pouhon.
23. Tarasp, Lucius Spring.
24. Vichy, Grande Grille.
25. Wiesbaden, Kochbrunnen.
26. Wildungen, Georg-Victor Brunnen.
27. Wildungen Helenenquelle.

C. Medicinal Waters and Similar Preparations

1. Acid Effervescent Waters, by Jacobsen.
   (*a*) Citric Acid.
   (*b*) Phosphoric Acid.
   (*c*) Citro-Phosphoric Acid.
   (*d*) Hydrochloric Acid.

2. Effervescent Waters, by Jaworski.
   (*a*) Alkaline Effervescent Water; simple and strong.
   (*b*) Effervescent Magnesia Water.

3. Effervescent Salts
   (*a*) General Employment.
   (*b*) Effervescent Bromide Salt.
   (*c*) " Bromide-Iron Salt.
   (*d*) " Lithium Salt.
   (*e*) " Magnesium Citrate.

4. Medicinal Effervescent Waters, by Jaworski.
5. Various Medicinal Waters.
   (*a*) Arsenic Water.
   (*b*) Bromine Water.
   (*c*) Iron Water.
   (*d*) Iodine Water.
   (*e*) Lithium Water.
   (*f*) Lithium-Soda Water.
   (*g*) Magnesia Water.
   (*h*) Silica-Calcium-Iron Water.
   (*i*) Urosin-Calcium-Iron Water.

6. Saccharin Lemonades for Diabetics.

II. The Fruit-Juice Industry

Constituents of Fruits and Fruit Juices (with tables).
(*a*) Percentage Composition of Fruits.
(*b*) Content of Sugar and Acids in Fruit Juices.

Manufacture of Fruit Juices.
The Spoiling of Fruit Juices and the Remedies.
Preservation Methods (Alcohol, Chemicals and Sterilization).
Natural Fruit Syrups.
Concentration of Fruit Juices.
Natural Lemonades and Fresh Fruit Beverages (with tables).
Citrus Fruit Juices.
Fruit Wines (with tables).
Honey-Fruit Wines.
Juices from Dried Fruits.
Jams and Jellies.

III. Essences for Lemonades and Non-Alcoholic Beverages

Fruit Flavors: Their Nature and Transfer to Essences.
Artificial Fruit Flavors, Fortifiers and Fixages.
Effervescent Lemonades.
Standard Essences and Extracts for Lemonades and Syrups.
Turbidity of Effervescent Lemonades.
Foam Producers.

General Methods for the Manufacture of Fruit Essences.

1. Vacuum Distillation.
   Vacuum Apparatus.
   Extraction.
   Distillation.

Concentration.
Removing Terpenes.
Diluting the Essences.

2. Distillation without a Vacuum.
3. Working up of Residues.
4. Methods of Extraction.
5. Isolating the Fruit Flavors (Aroma Oils).

Special Methods for Making Fruit Essences.

A. Berries.

1. *Wild Berries:* Bilberry (black and red), Cranberry, Mossberry.
2. *Important Cultivated Berries:* Raspberry, Strawberry, Currant, Gooseberry, Blackberry.
3. *The More Unusual Berries:* Barberry, Elderberry, Juniperberry, Mulberry, Sorbberry.

B. Stone Fruits: Agriot, Cherry, Plum (Mirabelle, Green Gage, Apricot, Peach).

C. Seed Fruits: Apple, Pear and Quince.

D. Citrus Fruits: Lemon, Lime, Orange, sweet and bitter (including methods for essences from volatile oils).

E. Exotic Fruits: Banana, Pineapple and Pomegranate.

F. Various Fruits: Melons and Cucumber.

Essences made from Other Plant Parts.

A. Celery and Rhubarb.

B. Hop and Malt.

C. Ginger and Woodruff.

D. Essences for Stimulant Beverages.

(*a*) "Cocoa" Essence.
(*b*) Chocolate Essence.
(*c*) Coffee Essence.
(*d*) Cola Essence.
(*e*) Tea Essence.

E. Essences from Volatile Oils and Artificial Flavors.

(*a*) Bitter Almond Essence.
(*b*) Honey Essence.
(*c*) Rose Essence.
(*d*) Sarsaparilla Essence.
(*e*) Vanilla Essence.
(*f*) Violet Essence.

Composition of Lemonade Essences

(*a*) *Artificial Fruit Flavors.*

1. Grenadine.
2. Currant.
3. Lime.
4. Messina Fruits.
5. Nectarine.
6. Tutti-Frutti.

(*b*) *Artificial Fruit Cup.*

7. Champagne Fruit Cup.
8. Swedish Fruit Bowl.
9. Cold Duck.

(c) *Artificial Wine Flavor.*

Basic Essences.

10. Claret Essence.
11. White Wine Essence.
12. Port Wine Essence.

Artificial Cider Lemonades.

13. Apple Cider.
14. Apricot Cider.
15. Currant Cider.
16. Peach Cider.

Champagne Lemonades.

17. Champagne Lemonade.
18. Champagne "Civilsekt."
19. Champagne a la Jacqueron.
20. " Veuve Cliquot.

Wine Lemonades.

21. Claret Lemonade.
22. Muscatel Wine Lemonade.
23. Nectar Lemonade.
24. White Wine Lemonade.

Punch Lemonades.

25. Claret Punch Lemonade.
26. Swedish Punch Lemonade.

(d) *Artificial Beer-Like Beverages.*

27. Gingerbeer Extract.
28. Malt Lemonade.
29. Mead Lemonade.
30. Dark Beer Lemonade (Munich type).
31. Light " " (Pilsen type).

(e) *Various Fancy Lemonades.*

32. Ambrosia.
33. Bicyclist Lemonade.
34. Crystal Spring.
35. Imperial Lemonade.
36. Marchpane Lemonade.
37. Maraschino Lemonade.
38. Oriental Lemonade.
39. Victoria Lemonade.

(f) 40. Ferruginous Lemonades.

(g) 41. Lactic Acid Lemonades.

Non-Alcoholic Fruit Flavors

Non-Alcoholic Punch Essences

1. Arrac Punch Essence.
2. Claret Punch Essence.
3. Coffee Punch Essence.
4. Cognac Punch Essence.
5. Fruit Punch Essence.
6. Mulled Punch Essence.
7. Imperial Punch Essence.
8. Rum Punch Essence.
9. Swedish Punch Essence.

Non-Alcoholic Beers and Wines.

Table of Acidity and Colors for Lemonades.

(a) Fruit Lemonades.

(b) Lemonades with the Taste of Other Plant Parts.

(c) Fancy Lemonades.

PART IV

NON-ALCOHOLIC BEVERAGES

The most natural drink for man or animal is pure *water*, which is an indispensable want of nature. It contains various mineral substances, so-called nutritive salts, which the organism needs. Besides water, fruits in particular are adapted for relieving thirst, and the water they contain holds in solution other refreshing and nutrient substances as acids, sugar, albumin, etc. Therefore fruit juices are often employed for preparing beverages, and, so far as their taste is concerned, they are often imitated, as in sparkling lemonades.

Apart from warm drinks like coffee, tea, cocoa, etc., only the natural and artificial mineral waters are really free from alcohol. Most other beverages, even though manufactured from fruit juices or essences, contain at least traces of alcohol. The lowest limit for alcohol in drinks in general is 1%, and for *non-alcoholic beverages* in the commercial sense 0.5% by volume, = 0.42% by weight, is taken as lowest limit.

I. The Mineral-Water Industry

The Quality of the Water

Water is the medium for the introduction of mineral substances into the organism, and the substances vary according to the origin of the water. Only a limited number of inorganic salts are contained in mineral waters, and they impart to the water a distinct taste, because pure distilled water is tasteless. The various inorganic salts exercise important functions in life processes, for organisms cannot live without such mineral salts. On the other hand some of the mineral salts are adapted to serve as medicaments, and therefore various mineral waters are esteemed as remedies.

The quality of the water depends upon the absence of some injurious constituents. Thus 100 cc. should not contain more than 0.01 mgm. ammonia, 2 mgm. chlorine, or 1 mgm. nitric acid;

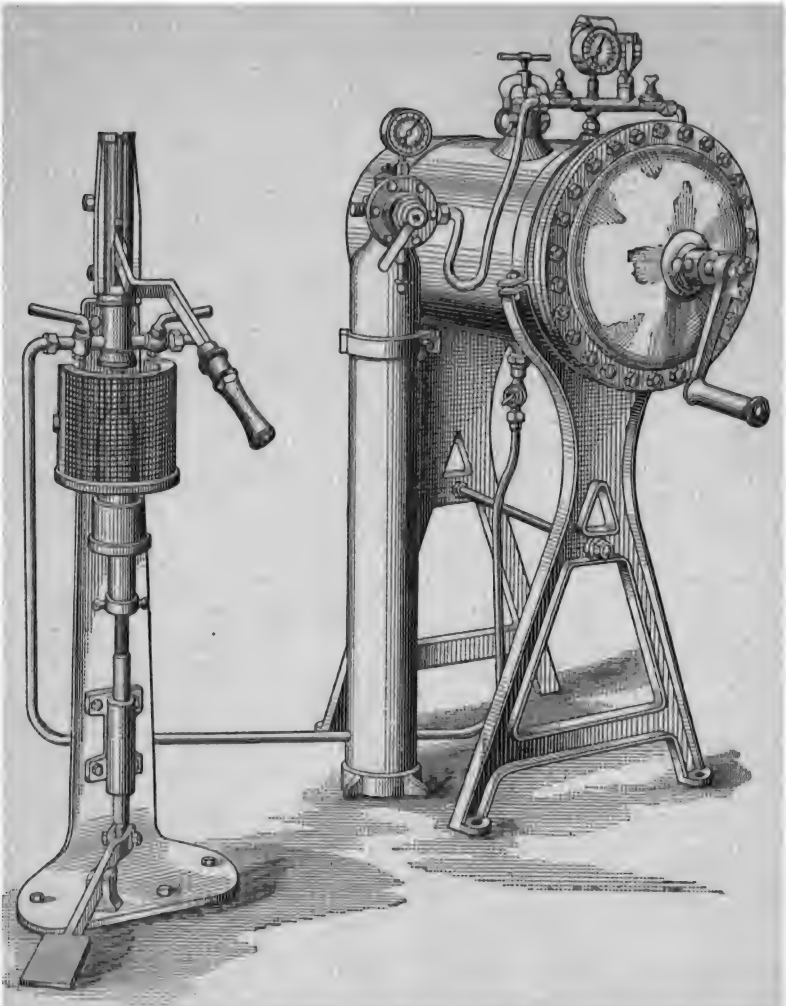


FIG. 17. FIG. 18.

Mineral-water apparatus with bottling machinery

nor should it contain phosphoric acid. Besides inorganic salts, organic substances and organisms of putrefaction are also often to be found. To oxidize the organic substances present not more than 0.08 to 0.10% of potassium permanganate should be required. The organic substances serve as a good nutrient medium for micro-organisms, particularly those causing putrefaction, and therefore a bacteriological examination of water is necessary.

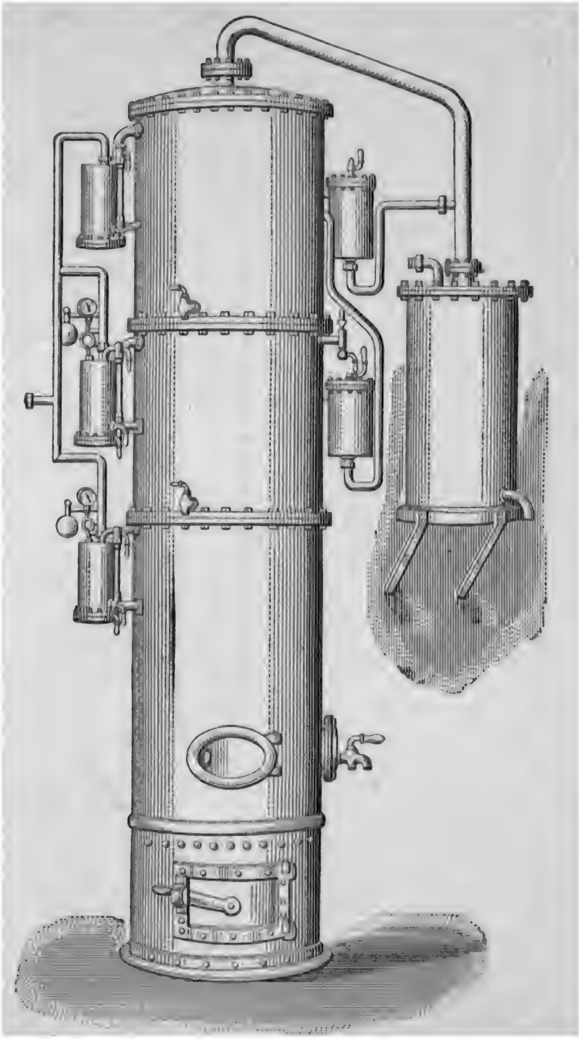


FIG. 19. Column water distilling apparatus. For better utilization of the heat several vessels are superimposed, and the vapors of one vessel heat the one just above it. The condensed water delivered by the worm constitutes the distilled water. The last vessel is connected with the condenser. Daily yield about 1000 gallons. Every 120 gallons require only about $1\frac{1}{2}$ quarters coal.

However, every water should be filtered before using it for any mineral or table water, and in cases where, for any reason it is not suitable, it should be distilled. The artificial mineral waters in particular should be manufactured only from distilled water. By distilling, the mineral and also the objectionable organic substances are retained in the still, and the distilled water is then tasteless.

Carbonic Acid

This is the most important constituent of non-alcoholic beverages, which are impregnated with carbonic acid in various well-known ways. Carbonic acid is most soluble in cold water, the solubility being increased by increase of atmospheric pressure with decrease in temperature. Table waters are saturated usually at 3 to 4 atmospheres, and artificial mineral waters at 1 to 2 atmospheres only.

Natural and Artificial Mineral Waters

The essence industry is interested in mineral waters only in so far as it deals with saline mixtures or with salts only. The addition of a flavor is not desired, and the use of fruit syrups or other flavoring with a mineral water is a matter of individual taste. *Natural mineral* waters are those which contain all the constituents originally present in the natural spring, and in unchanged form, and to which no other addition is made. However it is often necessary to improve the quality of natural waters by making some changes, such as to remove an excess of iron, or to add some sodium chloride, or to impregnate it with carbonic acid, but such manipulations must be declared, as also when a natural carbonated mineral water is further saturated with carbonic acid.

Artificial mineral waters are manufactured from distilled or other suitable natural sweet water, and they are nearly always saturated with carbonic acid after the addition of more or less inorganic salts. Such waters which are made in imitation of the natural springs must be declared as artificial, and those without any medicinal character are to be labeled as being *table water*.

In the following formulas the artificial mineral waters only will be considered either in the form of salt mixtures, which may be designated as "artificial mineral water salts," or in the form of solutions of definite saline contents.

Mineral Water Salts and Their Preparations

The mineral content of water is usually due to inorganic salts, and more rarely free inorganic acids are employed. Such are sulphuric, phosphoric and arsenous acids. For medicinal waters citric and tartaric acids are also required. Organic salts are very seldom employed in medicinal waters. Every chemical used must be chemically pure, or at least of the purity demanded by the Pharmacopœia. A large number of salts contain water of crystallization, which may be removed by drying. For salt mixtures the anhydrous form only is to be used except when the formula particularly calls for the crystallized salts. The salts are to be exsiccated in the manner directed by the Pharmacopœia, where this is given. The mineral water salts are marketed in powder form, but as they are very often hygroscopic, they must be kept in a dry place.

Regarding the order in which the salts must be dissolved, or solutions mixed, to avoid precipitates or other reactions, the following must be observed: First come the haloid salts as bromides, chlorides and iodides; then the sulphates, carbonates, nitrates, phosphates, silicates and free acids; and lastly the other constituents. With the exception of magnesium and calcium carbonates, all the salts are quite easily soluble. The magnesium and calcium carbonates are added last, and on impregnating the water with carbonic acid, they are converted into bicarbonates which are soluble. Any sodium sulphide is to be added last.

For salt mixtures the weight required to make 10 gallons of mineral water is given in every case. The salt is first dissolved in some water, then made up to 10 gallons, and then saturated with carbonic acid in the usual manner. In some cases, where the mixture is not suitable, the quantities of the individual salts required for 10 gallons are stated.

Normal Solutions of Mineral Water Salts

This method is the most suited for rapid manufacture, and for making small quantities of water. The salts are simply dissolved in the required quantity of water, and the solutions stored. The concentration of the solutions varies according to the solubility of the salts, hence with such salts as are used in but small quantities it is safer, to insure accuracy in measuring, to make use of more diluted solutions.

The most necessary salts, as sodium chloride, sodium carbonate, sodium sulphate and chlorides of calcium and magnesium, are used in most concentrated solution. The "*liter*," = 1000 cc., serves as the *normal measure.* The preparation of these normal solutions is always the same. The specified quantity of ingredients is dissolved in sufficient distilled water to make 1 liter of solution at the normal temperature of 15° C. = 65° F.

The content of crystallization water is considered only in cases of the highest concentrations of doublenormal solutions. It is far more convenient to dissolve crystallized salts, and therefore the quantities prescribed are equivalent to those of exsiccated salts.

Doublenormal Salt Solutions

Each liter contains 7 oz. 13 dr. exsiccated salt (22.14%).

8 cc. are equal to 1 dram } exsiccated salt.
128 " " " " 1 oz.

Each liter contains the following as *crystallized salts* dissolved to make 1 liter:

Calcium Chloride	1 lb.	– oz.	4 dr.	$CaCl_2 + 6\,H_2O$
Magnesium Chloride	– "	14 "	5 "	$MgCl_2 + 6\,H_2O$
Sodium Chloride	– "	7 "	13 "	$NaCl$
Magnesium Sulphate	– "	12 "	5 "	$MgSO_4 + 7\,H_2O$
Sodium Sulphate	– "	15 "	– "	$Na_2SO_4 + 7\,H_2O$
Sodium Carbonate	1 "	5 "	– "	$Na_2CO_3 + 10\,H_2O$

Normal Salt Solutions

Each liter contains 3 oz. 14½ dr. *crystallized* salt = 62½ dr. (11%).

8 cc. are equal to 1 dr. } crystallized salts.
256 " " " " 1 oz.

In every case 3 oz. 14½ dr. are dissolved to make 1 liter.

This concentration is employed for the following salts.

Sodium Bromide	$NaBr$	Manganese Sulphate	$MnSO_4$
Aluminum Chloride	$AlCl_3$	Potassium Carbonate	K_2CO_3
Ammonium Chloride	NH_4Cl	Sodium Biborate (Borax)	$Na_2B_4O_7$
Potassium Chloride	KCl	Sodium Nitrate	$NaNO_3$
Sodium Iodide	NaI	Sodium Phosphate	Na_2HPO_4
Iron Sulphate	$FeSO_4$	Sodium Silicate	Na_2SiO
Potassium Sulphate	K_2SO_4		

Tenthnormal Salt Solutions for Mineral Waters

Each liter contains 6¼ dr. (1.1%) crystallized salts. 10 cc. are equal to $\frac{1}{16}$ dr.

Suited for following salts:

Barium Chloride	$BaCl_2$	Sodium Sulphide	Na_2S
Lithium Chloride	$LiCl$	Lithium Carbonate	Li_2CO_3
Strontium Chloride	$SrCl_2$	Sodium Arsenate	$NaAsO_3$
Copper Sulphate	$CuSO_4$		

Sulphuric acid (H_2SO_4) is employed as a normal solution, and arsenic trioxide (arsenous acid, As_2O_3) in tenthnormal solution.

The employment of these solutions is very simple. The required amount is expressed in cubic centimeters which are measured by a suitable pipette, or better, a burette. Here, too, the order of mixing is as before. The haloid salts, as bromides, chlorides and iodides, may be mixed together, also the sulphates, and lastly the other solutions. For each group a separate vessel is to be used in order to avoid precipitates due to a chemical reaction.

A. Table Waters

Most carbonated table waters, like selters or soda water, contain chiefly sodium chloride and carbonate. When distilled water or a soft water is used the addition of calcium and magnesium chlorides is usual. The usual table waters are reproductions of the springs of Niederselters (Germany), such mountain springs as Hartzer, Sauerbrunnen, or Rhineland Springs (Appollinaris), or of Vichy. When the table water is named after a certain spring, its artificial character must be declared.

1. Selters Water, Common Type

For 10 gallons.

Sodium Carbonate	1½–2¼ oz.	= 96–144	cc. doublenormal	Na_2CO_3
Sodium Chloride	2¼–3 "	= 144–192	" "	NaCl

For soft or distilled water add

Calcium Chloride 1 oz. 3 dr. = 136 cc. doublenormal $CaCl_2$ and
Magnesium Chloride 12¾ dr. = 102 cc. " $MgCl_2$.

2. Selters Water, Dr. Struve

First Solution:		*Second Solution:*	
Sodium Carbonate.......	2 oz. 6 dr.	Magnesium Chloride........	4¾ dr.
Distilled Water to make 1 gallon.		Calcium Chloride...........	6 "
		Potassium Chloride.........	¼ oz.
		Sodium Chloride...........	4 "
		Distilled water to make 1 gallon.	

Take 1 gallon each to make 100 gallons Selters water.

For 10 gallons, using Normal Solutions:

Calcium Chloride, doublenormal	4.8 cc.
Magnesium Chloride, "	3.8 "
Potassium Chloride, tenthnormal......................	0.4 "
Sodium Chloride, doublenormal.......................	51.2 "
Sodium Carbonate, "	12.8 "

3. Soda Water

For 10 gallons.

(a) *For distilled or soft water.*

Sodium Carbonate....	1 oz. 7 dr.
Calcium Chloride.....	6¼ dr.
Magnesium Chloride..	7½ dr.

(b) *For hard water only.*

Sodium Chloride..........	7½ dr.
Sodium Carbonate.........	2½ oz.

With Normal Solutions:

(c) *For soft or distilled water.*

Calcium Chloride.....	50 cc.
Magnesium Chloride..	60 "
Sodium Carbonate....	90 "

(d) *For hard water only.*

Sodium Chloride...........	60 cc.
Sodium Carbonate.........	160 "

4. Table Water "Cosmos" (Standard of German Mineral Water Manufacturers' Union)

First Solution:

Sodium Chloride............	1 lb.
Sodium Sulphate, crystallized	½ oz.
Sodium Carbonate, crystallized	2 lb.

Distilled water to make 1 gallon.

Second Solution:

Calcium Chloride......	8 oz.
Magnesium Chloride ...	13 "

Distilled water to make 1 gallon.

To make 10 gallons mix 1 pint of first solution with 2 pints of the second solution.

Same content but simplified:

Salt Mixture: = *Normal Solutions:*

For 10 gallons.

	Salt Mixture		Normal Solutions	
Calcium Chloride......		12¾ dr.	134 cc.	doublenormal
Magnesium Chloride...	1 oz.	4¾ "	166 "	"
Sodium Chloride	1 "	8 "	192 "	"
Sodium Sulphate......	— "	2½ "	10 "	"
Sodium Carbonate.....	3 "	3 "	203 "	"

Various Salt Mixtures for Table Waters

Made with hard water, and especially suited for *compressed salt mixtures.*

Sodium bicarbonate often is used in salt mixtures, and where it is desirable to employ normal solutions it is calculated as carbonate.

5. Harzer Sauerbrunnen

Salt Mixture:

(6 oz. for 10 gallons.)

Sodium Chloride	6⅞ oz.
Sodium Bicarbonate ...	9 "
Sodium Sulphate.......	⅛ "
	1 lb.

Normal Solutions:

(For 10 gallons.)

NaCl.....	782 cc.	doublenormal
Na_2CO_3...	682 "	"
Na_2SO_4...	16 "	"

6. Selters Salt

Salt Mixture: (⅝ oz. for 10 gallons.)		*Normal Solutions:* (For 10 gallons.)		
Sodium Chloride.......	6½ oz.	NaCl	832 cc.	doublenormal
Sodium Bicarbonate....	9 "	Na_2CO_3 ..	772 "	"
Sodium Sulphate......	½ "	Na_2SO_4....	64 "	"
	1 lb.			

7. Table Water

Salt Mixture: (3½ oz. for 10 gallons.)		*Normal Solutions:* (For 10 gallons.)		
Sodium Chloride......	6 oz.	NaCl....	768 cc.	doublenormal
Sodium Bicarbonate...	7 "	Na_2CO_3..	565 "	"
Sodium Sulphate......	3 "	Na_2SO_4...	384 "	"
	1 lb.			

Salt Mixtures for Soft or Distilled Water

8. Apollinaris (Rhineland table water)

Salt Mixture: (5 oz. for 10 gallons.)			*Normal Solutions:* (For 10 gallons.)		
Calcium Chloride......	2 oz.	2 dr.	$CaCl_2$....	272 cc.	doublenormal
Magnesium Chloride...	3 "	7 "	$MgCl_2$....	440 "	"
Sodium Chloride	4 "	– "	NaCl	512 "	"
Sodium Carbonate.....	6 "	– "	Na_2CO_3 ..	768 "	"
Sodium Sulphate......	– "	7 "	Na_2SO_4...	56 "	"
	1 lb.				

9. Harzer Sazerbrunnen

Salt Mixture: (5 oz. for 10 gallons.)		*Normal Solutions:* (For 10 gallons.)		
Calcium Chloride......	2¾ oz.	$CaCl_2$....	312 cc.	doublenormal
Magnesium Chloride...	4 "	$MgCl_2$....	512 "	"
Sodium Chloride.......	5 "	NaCl	640 "	"
Sodium Sulphate......	¼ "	Na_2SO_4...	32 "	"
Sodium Carbonate.....	4 "	Na_2CO_3...	512 "	"
	1 lb.			

10. National Spring (Table Water)

Salt Mixture: (6 oz. for 10 gallons.)			*Normal Solutions:* (For 10 gallons.)		
Sodium Chloride......	8 oz.	10 dr.	NaCl...	1104 cc.	doublenormal
Sodium Carbonate.....	5 "	8 "	Na_2CO_3 ..	192 "	"
Sodium Sulphate......	1 "	8 "	Na_2SO_4...	704 "	"
Sodium Phosphate	– "	6 "	Na_2HPO_4.	96 "	normal
	1 lb.				

11. Temperance Table Water

Salt Mixture: (5 oz. for 10 gallons.)		*Normal Solutions:* (For 10 gallons.)		
Sodium Chloride......	4 oz.	$NaCl$....	512 cc.	doublenormal
Sodium Sulphate.....	1¼ "	Na_2SO_4...	160 "	"
Sodium Carbonate....	8 "	Na_2CO_3..	1024 "	"
Sodium Phosphate ...	2¾ "	Na_2HPO_4.	704 "	"
	1 lb.			

B. Artificial Mineral Waters

The formulas are those afforded by the analyses of the springs. The waters are usually impregnated with carbonic acid at a pressure of 1 to 2 atmospheres. The medicinal effect of natural mineral waters depends not alone upon the salts and their influence on the organism, but also upon the temperature at which the water is drunk, the surroundings, the change of air, and other circumstances which exert a physiological influence upon the body. Some even assert that the radium content contributes to the important effect of natural waters. Artificial waters of course cannot exert such an action.

The formulas are calculated for 10 lb. of salt mixture, which may be sold as such as a medicament, or compressed in tablets with a label of directions for use. On the other hand, the employment of normal solutions is described for the rapid manufacture of such waters. As far as effervescent salts are concerned, the same composition is used, but with the addition of tartaric acid and sodium bicarbonate as described under *effervescent salts*.

1. Aix-la-Chapelle, Imperial Spring

Salt Mixture: (10 dr. per gallon = 9/16 dr. per glass.)

Normal Solutions: (For 10 gallons.)

Sodium Bromide	— lb.	2 oz.	2⅜ dr.	$NaBr$	15 cc.	tenthnormal
Calcium Chloride	— "	— "	11½ "	$CaCl_2$	3.7 "	doublenormal
Potassium Chloride	— "	5 "	6 "	KCl	55 "	normal
Lithium Chloride	— "	— "	2¼ "	$LiCl$	14.4 "	tenthnormal
Sodium Chloride	6 "	5 "	5 "	$NaCl$	513 "	doublenormal
Strontium Chloride	— "	— "	¼ "	$SrCl_2$	1.6 "	tenthnormal
Sodium Iodide	— "	— "	⅜ "	NaI	1.2 "	"
Iron Sulphate	— "	— "	8¾ "	$FeSO_4$	5.6 "	normal
Magnesium Sulphate	— "	3 "	— "	$MgSO_4$	15.4 "	doublenormal
Sodium Sulphate	— "	12 "	12 "	Na_2SO_4	65.3 "	"

Sodium Carbonate	1 lb.	12 oz.	8 dr.	Na_2CO_3	146	cc. doublenormal
Sodium Silicate	— "	5 "	7½ "	Na_2SiO_3	56	" normal
Sodium Sulphide*	— "	— "	— "	Na_2S	0.5	" "
	10 lb.					

* Sodium Sulphide: Add to each 10 gallons 0.5 cc. normal solution.

2. Apollinaris (Rhineland Spring)

Salt Mixture: (9½ dr. per gallon = ½ dr. per glass.)

Normal Solutions: (For 10 gallons.)

Calcium Chloride	1 lb.	8 oz.	5 dr.	$CaCl_2$	105	cc. doublenormal
Magnesium Chloride	1 "	10 "	7 "	$MgCl_2$	130	" "
Sodium Chloride	— "	7 "	12 "	$NaCl$	36.5	" "
Sodium Sulphate	— "	8 "	— "	Na_2SO_4	38	" "
Sodium Carbonate	5 "	13 "	8 "	Na_2CO_3	450	" "
	10 lb.					

3. Baden-Baden (Head-Stulm)

Salt Mixture: (7 dr. per gallon = ⅜ dr. per glass.)

Normal Solutions: (For 10 gallons.)

Ammonium Chloride	— lb.	— oz.	5 dr.	NH_4Cl	2.2	cc. normal
Calcium Chloride	— "	6 "	3 "	$CaCl_2$	21.5	" doublenormal
Potassium Chloride	— "	7 "	8 "	KCl	52.5	" normal
Sodium Chloride	8 "	3 "	9 "	$NaCl$	455	" doublenormal
Potassium Sulphate	— "	— "	13 "	K_2SO_4	5.6	" normal
Sodium Phosphate	— "	— "	5 "	Na_2HPO_4	2.2	" tenthnormal
Sodium Silicate	— "	13 "	5 "	Na_2SiO_3	91	" normal
	10 lb.					

4. Bilin (Sour Spring), Josef-Spring (Bohemia)

Salt Mixture: (12 dr. per gallon = 1⅛ dr. per glass.)

Normal Solutions: (For 10 gallons.)

Aluminum Chloride	— lb.	— oz.	⅛ dr.	$AlCl_3$	1	cc. tenthnormal
Calcium Chloride	— "	14 "	— "	$CaCl_2$	85.3	" doublenormal
Lithium Chloride	— "	— "	6⅜ "	$LiCl$	48	" tenthnormal
Iron Sulphate	— "	— "	2 "	$FeSO_4$	1.5	" normal
Potassium Sulphate	— "	8 "	— "	Na_2SO_4	98	" "
Manganese Sulphate	— "	— "	⅜ "	$MnSO_4$	3	" tenthnormal
Magnesium Sulphate	— "	8 "	— "	$MgSO_4$	49	" doublenormal
Sodium Sulphate	— "	14 "	— "	Na_2SO_4	85.3	" "
Sodium Carbonate	7 "	— "	7 "	Na_2CO_3	685	" "
Sodium Phosphate	— "	— "	⅛ "	Na_2HPO_4	1	" tenthnormal
Sodium Silicate	— "	3 "	— "	Na_2SiO_3	36.5	" normal
	10 lb.					

5. Eger, Franzensbrunnen (Bohemia)

Salt Mixture: *Normal Solutions:*

(15 dr. per gallon = ¾ dr. per glass.) (For 10 gallons.)

Aluminum Chloride	— lb.	— oz.	⅛ dr.	$AlCl_3$	8.4 cc.	tenthnormal
Calcium Chloride	— "	8 "	— "	$CaCl_2$	60 "	doublenormal
Lithium Chloride	— "	— "	2⅝ "	$LiCl$	24 "	tenthnormal
Sodium Chloride	1 "	11 "	— "	$NaCl$	203 "	doublenormal
Strontium Chloride	— "	— "	⅛ "	$SrCl_2$	1.2 "	tenthnormal
Iron Sulphate	— "	1 "	2½ "	$FeSO_4$	18 "	normal
Manganese Sulphate	— "	— "	3⅜ "	$MnSO_4$	3.2 "	"
Magnesium Sulphate	— "	3 "	12 "	$MgSO_4$	28 "	doublenormal
Sodium Sulphate	5 "	9 "	13 "	Na_2SO_4	676 "	"
Sodium Carbonate	1 "	10 "	— "	Na_2CO_3	196 "	"
Sodium Phosphate	— "	— "	2½ "	Na_2HPO_4	23 "	tenthnormal
Sodium Silicate	— "	3 "	11 "	Na_2SiO_3	55.5 "	normal
	10 lb.					

6. Emser Kraehnchen

Salt Mixture: *Normal Solutions:*

(6½ dr. per gallon = ⅜ dr. per glass.) (For 10 gallons.)

Sodium Bromide	— lb.	— oz.	⅜ dr.	$NaBr$	3 cc.	tenthnormal
Aluminum Chloride	— "	— "	⅜ "	$AlCl_3$	3 "	"
Ammonium Chloride	— "	— "	2¼ "	NH_4Cl	18 "	"
Barium Chloride	— "	— "	⅛ "	$BaCl_2$	1 "	"
Calcium Chloride	— "	10 "	7 "	$CaCl_2$	67 "	doublenormal
Potassium Chloride	— "	2 "	— "	KCl	25.6 "	normal
Lithium Chloride	— "	— "	3 "	$LiCl$	24 "	tenthnormal
Magnesium Chloride	— "	9 "	8⅛ "	$MgCl_2$	61 "	doublenormal
Sodium Chloride	2 "	5 "	6 "	Na_2Cl	239 "	"
Strontium Chloride	— "	— "	2 "	$SrCl_2$	16 "	tenthnormal
Sodium Iodide	— "	— "	1/16 "	KI	0.5 "	"
Iron Sulphate	— "	— "	2 "	$FeSO_4$	1.6 "	normal
Manganese Sulphate	— "	— "	⅛ "	$MnSO_4$	1 "	tenthnormal
Sodium Sulphate	— "	4 "	— "	Na_2SO_4	25.6 "	doublenormal
Sodium Carbonate	5 "	9 "	— "	Na_2CO_3	572 "	"
Sodium Phosphate	— "	— "	1 9/16 "	Na_2HPO_4	12.5 "	tenthnormal
Sodium Silicate	— "	6 "	6 "	Na_2SiO_3	815 "	normal
	10 lb.					

7. Fachinger (Table Water)

Salt Mixture: *Normal Solutions:*

(9½ dr. per gallon = 9/16 dr. per glass.) (For 10 gallons.)

Sodium Bromide	— lb.	— oz.	⅛ dr.	$NaBr$	0.7 cc.	tenthnormal
Ammonium Chloride	— "	— "	1 "	NH_4Cl	6 "	"
Barium Chloride	— "	— "	3/16 "	$BaCl$	1.1 "	"

Calcium Chloride	1 lb.	3 oz.	12 dr.	$CaCl_2$	93 cc.	doublenormal
Potassium Chloride	— “	3 “	4 “	KCl	3.8 “	normal
Lithium Chloride	— “	— “	$3\frac{3}{8}$ “	$LiCl$	20 “	tenthnormal
Magnesium Chloride	— “	13 “	$8\frac{5}{8}$ “	$MgCl_2$	64 “	doublenormal
Strontium Chloride	— “	— “	$2\frac{1}{4}$ “	$SrCl_2$	13 “	tenthnormal
Sodium Iodide	— “	— “	$\frac{1}{100}$ “	NaI	0.05 “	“
Iron Sulphate	— “	— “	$3\frac{1}{4}$ “	$FeSO_4$	2 “	normal
Manganese Sulphate	— “	— “	$8\frac{7}{10}$ “	$MnSO_4$	5 “	“
Magnesium Sulphate	— “	— “	$14\frac{1}{16}$ “	$MgSO_4$	4.6 “	doublenormal
Sodium Carbonate	7 “	7 “	4 “	Na_2CO_3	565 “	“
Sodium Nitrate	— “	— “	$\frac{1}{16}$ “	$NaNO_3$	0.35 “	tenthnormal
Sodium Phosphate	— “	— “	$\frac{1}{4}$ “	Na_2HPO_4	1.4 “	“
Sodium Silicate	— “	2 “	$1\frac{3}{4}$ “	Na_2SiO_3	20 “	normal
	10 lb.					

8. Franzensbad (Salt-Spring)

Salt Mixture: *Normal Solutions:*

(12¼ dr. per gallon = $\frac{1}{16}$ dr. per glass.) (For 10 gallons.)

Calcium Chioride	— lb.	6 oz.	14 dr.	$CaCl_2$	44 cc.	doublenormal
Lithium Chloride	— “	— “	$1\frac{5}{8}$ “	$LiCl$	13 “	tenthnormal
Sodium Chloride	2 “	2 “	— “	$NaCl$	217 “	doublenormal
Iron Sulphate	— “	— “	$6\frac{3}{8}$ “	$FeSO_4$	5.1 “	normal
Manganese Sulphate	— “	— “	$\frac{7}{8}$ “	$MnSO_4$	7 “	tenthnormal
Magnesium Suphate	— “	5 “	— “	$MgSO_4$	32 “	doublenormal
Sodium Sulphate	5 “	2 “	12 “	Na_2SO_4	530 “	“
Sodium Carbonate	1 “	10 “	6 “	Na_2CO_3	170 “	“
Sodium Phosphate	— “	— “	$1\frac{1}{2}$ “	Na_2HPO_4	12 “	tenthnormal
Sodium Silicate	— “	4 “	$5\frac{5}{8}$ “	Na_2SiO_3	56 “	normal
	10 lb.					

9. Friedrichshall Bitter Water

Salt Mixture: *Normal Solutions:*

(6½ dr. per gallon = ⅜ dr. per glass.) (For 10 gallons.)

Sodium Bromide	— lb.	— oz.	$13\frac{1}{8}$ dr.	$NaBr$	52 cc.	tenthnormal
Calcium Chloride	— “	7 “	5 “	$CaCl_2$	23.5 “	doublenormal
Potassium Chloride	— “	1 “	$\frac{7}{8}$ “	KCl	6.7 “	normal
Sodium Chloride	4 “	8 “	7 “	$NaCl$	233 “	doublenormal
Magnesium Sulphate	4 “	5 “	8 “	$MgSO_4$	222 “	“
Sodium Sulphate	— “	4 “	14 “	Na_2SO_4	15.6 “	“
Sodium Carbonate	— “	4 “	— “	Na_2CO_3	12.8 “	“
	10 lb.					

10. Harzer Sauerbrunnen

Salt Mixture: *Normal Solutions:*

(2½ dr. per gallon = ⅛ dr. per glass.) (For 10 gallons.)

Calcium Chloride	1 lb.	14 oz.	— dr.	$CaCl_2$	38.4 cc.	doublenormal
Potassium Chloride	— “	— “	15 “	KCl	2.4 “	normal

Magnesium Chloride	— lb.	4 oz.	9 dr.	$MgCl_2$	5.8 cc.	doublenormal
Sodium Chloride	4 "	7 "	14 "	$NaCl$	92 "	"
Sodium Sulphate	— "	2 "	10 "	Na_2SO_4	3.6 "	"
Sodium Carbonate	3 "	— "	— "	Na_2CO_3	61.5 "	"
Sodium Silicate	— "	2 "	— "	Na_2SiO_3	5.2 "	normal
	10 lb.					

11. Hunyadi-Janos, Hungarian Bitter Water (Ofen, Hungary)

Salt Mixture: *Normal Solutions:*

(1 oz. 3 dr. per gallon = 1 dr. per glass.) (For 10 gallons.)

Calcium Chloride	— lb.	4 oz.	— dr.	$CaCl_2$	220 cc.	doublenormal
Sodium Chloride	— "	1 "	9 "	$NaCl$	80 "	"
Iron Sulphate	— "	— "	¼ "	$FeSO_4$	1.7 "	normal
Potassium Sulphate	— "	— "	6¼ "	K_2SO_4	42 "	"
Magnesium Sulphate	4 "	6 "	15 "	$MgSO_4$	3800 "	doublenormal
Sodium Sulphate	4 "	8 "	— "	Na_2SO_4	3500 "	"
Sodium Carbonate	— "	11 "	— "	Na_2CO_3	590 "	"
Sodium Silicate	— "	— "	1½ "	Na_2SiO_3	10 "	normal
	10 lb.					

12. Karlsbad, Mühlbrunnen (Bohemia)

Salt Mixture: *Normal Solutions:*

(1 oz. per gallon = 5 dr. per glass.) (For 10 gallons.)

Calcium Chloride	— lb.	8 oz.	5 dr.	$CaCl_2$	66.5 cc.	doublenormal
Lithium Chloride	— "	— "	6¼ "	$LiCl$	62.5 "	tenthnormal
Magnesium Chloride	— "	4 "	11 "	$MgCl_2$	37.5 "	doublenormal
Sodium Chloride	1 "	11 "	— "	$NaCl$	216 "	"
Potassium Sulphate	— "	5 "	— "	K_2SO_4	80 "	normal
Sodium Sulphate	4 "	9 "	8 "	Na_2SO_4	588 "	doublenormal
Sodium Carbonate	2 "	5 "	— "	Na_2CO_3	296 "	"
Sodium Biborate (Borax)	— "	— "	1¾ "	$Na_2B_4O_7$	18.5 "	normal
Sodium Silicate	— "	4 "	— "	Na_2SiO_3	64.5 "	"
	10 lb.					

13. Kissingen, Rakoczi (Bavaria)

Salt Mixture: *Normal Solutions:*

(1 oz. 3 dr. per gallon = 1 dr. per glass.) (For 10 gallons.)

Sodium Bromide	— lb.	— oz.	5 dr.	$NaBr$	60 cc.	tenthnormal
Ammonium Chloride	— "	— "	⅝ "	NH_4Cl	7.4 "	"
Calcium Chloride	1 "	12 "	— "	$CaCl_2$	265 "	doublenormal
Lithium Chloride	— "	— "	7 "	$LiCl$	83 "	tenthnormal
Magnesium Chloride	— "	10 "	⅛ "	$MgCl_2$	95 "	doublenormal
Sodium Chloride	6 "	6 "	6 "	$NaCl$	970 "	"

Potassium Sulphate	— lb.	7 oz.	— dr.	K_2SO_4	133	cc.	normal
Magnesium Sulphate	— "	9 "	— "	$MgSO_4$	85	"	doublenormal
Sodium Phosphate	— "	2 "	5 "	Na_2HPO_4	44	"	normal
Sodium Silicate	— "	— "	8¼ "	Na_2SiO_3	100	"	"
	10 lb.						

14. Levico, Iron-Arsenic Spring (South Tyrol)

Salt Mixture: *Normal Solutions:*

(3½ dr. per gallon = $\frac{3}{16}$ dr. per glass.) (For 10 gallons.)

Arsenous Acid	— lb.	— oz.	1¾ dr.	As_2O_3	4	cc.	tenthnormal
Sulphuric Acid	— "	11 "	15 "	H_2SO_4	40	"	normal
Ammonium Chloride	— "	— "	11½ "	NH_4Cl	24	"	tenthnormal
Calcium Chloride	1 "	8 "	11 "	$CaCl_2$	42.5	"	doublenormal
Aluminum Sulphate	— "	1 "	10 "	$Al_2(SO_4)_3$	60	"	normal
Copper Sulphate	— "	— "	9½ "	$CuSO_4$	20	"	tenthnormal
Iron Sulphate	4 "	13 "	7 "	$FeSO_4$	251	"	normal
Potassium Sulphate	— "	— "	1¾ "	K_2SO_4	0.4	"	"
Magnesium Sulphate	1 "	10 "	12½ "	$MgSO_4$	46	"	doublenormal
	10 lb.						

15. Marienbad, Kreuzbrunnen (Bohemia)

Salt Mixture: *Normal Solutions:*

(1 oz. 6 dr. per gallon = 1¼ dr. per glass.) (For 10 gallons.)

Aluminum Chloride	— lb.	— oz.	1⅜ dr.	$AlCl_3$	19	cc.	tenthnormal
Calcium Chloride	1 "	— "	9 "	$CaCl_2$	184	"	doublenormal
Potassium Chloride	— "	— "	14 "	KCl	19.5	"	normal
Lithium Chloride	— "	— "	1½ "	$LiCl$	21	"	tenthnormal
Sodium Chloride	1 "	3 "	6 "	$NaCl$	215	"	doublenormal
Iron Sulphate	— "	— "	13½ "	$FeSO_4$	18	"	normal
Manganese Sulphate	— "	— "	1⅛ "	$MnSO_4$	15.7	"	"
Magnesium Sulphate	— "	11 "	7 "	$MgSO_4$	122	"	doublenormal
Sodium Sulphate	4 "	13 "	— "	Na_2SO_4	856	"	"
Sodium Carbonate	2 "	1 "	8 "	Na_2CO_3	373	"	"
Sodium Phosphate	— "	— "	2½ "	Na_2SiO_3	35	"	normal
	10 lb.						

16. Neuenahr, Sprudel

Salt Mixture: *Normal Solutions:*

(5 dr. per gallon = $\frac{5}{16}$ oz. per glass.) (For 10 gallons.)

Calcium Chloride	— lb.	12 oz.	— dr.	$CaCl_2$	31	cc.	doublenormal
Lithium Chloride	— "	— "	1⅛ "	$LiCl$	3.6	"	tenthnormal
Magnesium Chloride	2 "	5 "	— "	$MgCl_2$	94.5	"	doublenormal
Potassium Sulphate	— "	7 "	8⅞ "	K_2SO_4	38.7	"	normal
Manganese Sulphate	— "	5 "	2 "	$MnSO_4$	26	"	"
Magnesium Sulphate	— "	4 "	7 "	$MgSO_4$	23	"	doublenormal

Sodium Carbonate	5 lb.	6 oz.	12 dr.	Na_2CO_3	222 cc.	doublenormal
Sodium Silicate	– "	7 "	1 "	Na_2SiO_3	36 "	normal
	10 lb.					

17. Nieder Selters

Most artificial selters waters are made to resemble the natural water from this spring.

Salt Mixture: (9½ dr. per gallon = ½ dr. per glass.)

Normal Solutions: (For 10 gallons.)

Sodium Bromide	– lb.	– oz.	$1\frac{3}{16}$ dr.	NaBr	5 cc.	tenthnormal
Ammonium Chloride	– "	– "	3½ "	NH_4Cl	2.1 "	normal
Barium Chloride	– "	– "	¼ "	$BaCl_2$	1.5 "	tenthnormal
Calcium Chloride	– "	15 "	1½ "	$CaCl_2$	71.5 "	doublenormal
Potassium Chloride	– "	– "	8 "	KCl	4.8 "	normal
Lithium Chloride	– "	– "	2½ "	LiCl	15 "	tenthnormal
Magnesium Chloride	– "	8 "	12 "	$MgCl_2$	41.5 "	doublenormal
Sodium Chloride	4 "	10 "	4¾ "	NaCl	352 "	"
Strontium Chloride	– "	– "	⅛ "	$SrCl_2$	0.8 "	tenthnormal
Sodium Iodide	– "	– "	$\frac{1}{16}$ "	Na	0.4 "	"
Iron Sulphate	– "	– "	2½ "	$FeSO_4$	1.5 "	normal
Magnesium Sulphate	– "	1 "	4 "	$MgSO_4$	6 "	doublenormal
Manganese Sulphate	– "	– "	½ "	$MnSO_4$	0.3 "	normal
Sodium Carbonate	3 "	10 "	– "	Na_2CO_3	275 "	doublenormal
Sodium Nitrate	– "	– "	4½ "	$NaNO_3$	2.6 "	normal
Sodium Phosphate	– "	– "	½ "	Na_2HPO_4	3 "	"
Sodium Silicate	– "	1 "	2½ "	Na_2SiO_3	11 "	"
	10 lb.					

18. Pyrmont, Head-Spring; Steel-Spring

Salt Mixture: (3¾ dr. per gallon = $\frac{3}{16}$ dr. per glass.)

Normal Solutions: (For 10 gallons.)

Sodium Bromide	– lb.	– oz.	⅛ dr.	NaBr	0.3 cc.	tenthnormal
Aluminum Chloride	– "	– "	$\frac{1}{32}$ "	$AlCl_3$	0.075 "	"
Ammonium Chloride	– "	– "	3½ "	NH_4Cl	0.7 "	"
Barium Chloride	– "	– "	½ "	$BaCl_2$	1.2 "	"
Calcium Chloride	1 "	10 "	7 "	$CaCl_2$	48.2 "	doublenormal
Potassium Chloride	– "	1 "	8¼ "	KCl	5.5 "	normal
Lithium Chloride	– "	– "	$1\frac{18}{16}$ "	LiCl	4.2 "	tenthnormal
Strontium Chloride	– "	– "	5 "	$SrCl_2$	1.2 "	"
Sodium Iodide	– "	– "	$\frac{1}{32}$ "	NaI	0.075 "	"
Iron Sulphate	– "	7 "	12 "	$FeSO_4$	28.3 "	normal
Manganese Sulphate	– "	– "	10 "	$MnSO_4$	2.3 "	"
Magnesium Sulphate	3 "	9 "	6 "	$MgSO_4$	105 "	doublenormal
Sodium Sulphate	3 "	10 "	13½ "	Na_2SO_4	32 "	"

Sulphuric Acid* (omitted in salt mixture)	— lb.	— oz.	— dr.	H_2SO_4	118.2	cc.	normal
Sodium Nitrate	— "	— "	¼ "	$NaNO_3$	0.6	"	tenthnormal
Sodium Phosphate	— "	— "	¼ "	Na_2HPO_4	0.6	"	"
Sodium Silicate	— "	6 "	11 "	Na_2SiO_3	24.5	"	normal
	10 lb.						

* Free sulphuric acid is used in the form of normal solution. The content of sodium sulphate is in this case lower than in the salt mixture.

19. Salzbrunnen, Crown-Spring (Silesia)

Salt Mixture: *Normal Solutions:*

(6½ dr. per gallon = $\frac{7}{16}$ dr. per glass.) (For 10 gallons.)

Sodium Bromide	— lb.	— oz.	⅞ dr.	NaBr	3.5	cc.	tenthnormal
Ammonium Chloride	— "	— "	⅝ "	NH_4Cl	2.5	"	"
Calcium Chloride	1 "	8 "	— "	$CaCl_2$	75	"	doublenormal
Lithium Chloride	— "	— "	1$\frac{1}{16}$ "	LiCl	4.3	"	tenthnormal
Magnesium Chloride	— "	— "	5⅜ "	$MgCl_2$	2.1	"	doublenormal
Strontium Chloride	— "	— "	4 "	$SrCl_2$	1.6	"	tenthnormal
Iron Sulphate	— "	— "	6 "	$FeSO_4$	2.4	"	normal
Manganese Sulphate	— "	— "	1 "	$MnSO_4$	0.4	"	"
Potassium Sulphate	— "	3 "	12 "	K_2SO_4	24	"	"
Magnesium Sulphate	1 "	11 "	— "	$MgSO_4$	86	"	doublenormal
Sodium Carbonate	6 "	4 "	5 "	Na_2CO_3	320	"	"
Sodium Nitrate	— "	— "	7 "	$NaNO_3$	5.6	"	tenthnormal
Sodium Phosphate	— "	— "	$\frac{1}{16}$ "	Na_2HPO_4	0.25	"	"
Sodium Silicate	— "	3 "	5 "	Na_2SiO_3	42	"	normal
	10 lb.						

20. Salzschlirf, Bonifacius Spring

Salt Mixture: *Normal Solutions:*

(2¼ oz. per gallon = 2 dr. per glass.) (For 10 gallons.)

Sodium Bromide	— lb.	— oz.	1 dr.	NaBr	23	cc.	tenthnormal
Calcium Chloride	1 "	8 "	— "	$CaCl_2$	440	"	doublenormal
Potassium Chloride	— "	1 "	10 "	KCl	60	"	normal
Lithium Chloride	— "	2 "	9½ "	LiCl	950	"	tenthnormal; a stronger solution is not objectionable.
Sodium Chloride	6 "	5 "	— "	NaCl	1810	cc.	doublenormal
Sodium Iodide	— "	— "	1 "	NaI	23	"	tenthnormal
Iron Sulphate	— "	— "	2½ "	$FeSO_4$	5.8	"	normal
Magnesium Sulphate	1 "	— "	12 "	$MgSO_4$	307	"	doublenormal
Sodium Sulphate	— "	3 "	— "	Na_2SO_4	55	"	"
Sodium Carbonate	— "	8 "	— "	Na_2CO_3	147	"	"
Sodium Silicate	— "	2 "	12 "	Na_2SiO_3	100	"	normal
	10 lb.						

21. Soden, Taunus; Warmbrunnen No. 3

Salt Mixture: ($\frac{3}{4}$ oz. per gallon = $\frac{5}{8}$ dr. per glass.)

Normal Solutions: (For 10 gallons.)

Sodium Bromide	— lb.	— oz.	$\frac{3}{8}$ dr.	NaBr	3 cc.	tenthnormal
Aluminum Chloride	— "	— "	$2\frac{3}{8}$ "	$AlCl_3$	1.9 "	"
Calcium Chloride	1 "	9 "	— "	$CaCl_2$	160 "	doublenormal
Potassium Chloride	— "	5 "	7 "	KCl	70 "	normal
Lithium Chloride	— "	— "	$1\frac{1}{4}$ "	LiCl	10 "	tenthnormal
Magnesium Chloride	— "	14 "	$11\frac{3}{8}$ "	$MgCl_2$	95 "	doublenormal
Sodium Chloride	4 "	8 "	— "	NaCl	568 "	"
Iron Sulphate	— "	8 "	$8\frac{3}{4}$ "	$FeSO_4$	7 "	normal
Manganese Sulphate	— "	— "	$\frac{7}{8}$ "	$MnSO_4$	0.7 "	"
Magnesium Sulphate	— "	— "	8 "	$MgSO_4$	3.2 "	doublenormal
Sodium Carbonate	2 "	8 "	— "	Na_2CO_3	256 "	"
Sodium Silicate	— "	1 "	8 "	Na_2SiO_3	19 "	normal
	10 lb.					

22. Spaa, Pouhon

Salt Mixture: ($\frac{3}{4}$ dr. per gallon = $\frac{1}{16}$ dr. per glass.)

Normal Solutions: (For 10 gallons.)

Aluminum Chloride	— lb.	13 oz.	— dr.	$AlCl_3$	10 cc.	tenthnormal
Calcium Chloride	— "	11 "	— "	$CaCl_2$	4.1 "	doublenormal
Magnesium Chloride	— "	— "	$1\frac{3}{4}$ "	$MgCl_2$	0.03 "	"
Iron Sulphate	4 "	13 "	— "	$FeSO_4$	58 "	normal
Manganese Sulphate	— "	1 "	5 "	$MnSO_4$	1 "	"
Magnesium Sulphate	— "	6 "	— "	$MgSO_4$	2.6 "	doublenormal
Potassium Carbonate	— "	2 "	$13\frac{3}{4}$ "	K_2CO_3	2 "	normal
Sodium Carbonate	2 "	3 "	7 "	Na_2CO_3	13 "	doublenormal
Sodium Silicate	— "	13 "	$4\frac{1}{2}$ "	Na_2SiO_3	2 "	normal
Sodium Sulphide (To be omitted in salt mixture)	— "	— "	— "	Na_2S	1.7 "	tenthnormal
	10 lb.					

23. Tarasp, Lucius Spring

Salt Mixture: ($1\frac{3}{8}$ oz. per gallon = 2 dr. per glass.)

Normal Solutions: (For 10 gallons.)

Ammonium Bromide	— lb.	— oz.	9 dr.	NH_4Br	90 cc.	tenthnormal
Sodium Bromide	— "	— "	$6\frac{1}{4}$ "	NaBr	62.5 "	"
Calcium Chloride	1 "	7 "	— "	$CaCl_2$	184 "	doublenormal
Lithium Chloride	— "	— "	$\frac{1}{2}$ "	LiCl	5 "	tenthnormal
Magnesium Chloride	— "	9 "	— "	$MgCl_2$	72 "	doublenormal
Sodium Chloride	2 "	12 "	— "	NaCl	352 "	"
Sodium Iodide	— "	— "	$\frac{1}{4}$ "	NaI	2.5 "	tenthnormal

Potassium Sulphate	— lb.	7 oz.	— dr.	K_2SO_4	112	cc. normal
Sodium Sulphate	1 "	14 "	— "	Na_2SO_4	240	" doublenormal
Sodium Carbonate	2 "	10 "	1 "	Na_2CO_3	336	" "
Sodium Nitrate	— "	— "	$\frac{1}{8}$ "	$NaNO_3$	1.3	" tenthnormal
Sodium Biborate (Borax)	— "	3 "	11 "	$Na_2B_4O_7$	59	" normal
Sodium Phosphate	— "	— "	$\frac{5}{8}$ "	Na_2HPO_4	6.3	" tenthnormal
Sodium Silicate	— "	— "	$3\frac{1}{4}$ "	Na_2SiO_3	33	" normal
	10 lb.					

24. Vichy, Grande Grille

Salt Mixture: (12 dr. per gallon = $\frac{11}{16}$ dr. per glass.)

Normal Solutions: (For 10 gallons.)

Calcium Chloride	— lb.	11 oz.	— dr.	$CaCl_2$	70	cc. doublenormal
Magnesium Chloride	— "	5 "	— "	$MgCl_2$	30	" "
Strontium Chloride	— "	— "	$1\frac{1}{4}$ "	$SrCl_2$	0.8	" tenthnormal
Iron Sulphate	— "	— "	2 "	$FeSO_4$	0.8	" normal
Magnesium Sulphate	— "	3 "	6 "	$MgSO_4$	20	" doublenormal
Sodium Sulphate	— "	5 "	12 "	Na_2SO_4	35	" "
Potassium Carbonate	— "	8 "	$\frac{13}{16}$ "	K_2CO_3	100	" normal
Sodium Carbonate	7 "	5 "	7 "	Na_2SO_4	716	" doublenormal
Sodium Phosphate	— "	4 "	6 "	Na_2HPO_4	53	" normal
Sodium Arsenate	— "	— "	$1\frac{1}{16}$ "	Na_3AsO_3	0.8	" tenthnormal
Sodium Silicate	— "	4 "	12 "	Na_3SiO_4	61	" normal
	10 lb.					

25. Wiesbaden, Kochbrunnen

Salt Mixture: (1 oz. 4 dr. per gallon = $1\frac{1}{8}$ dr. per glass.)

Normal Solutions: (For 10 gallons.)

Sodium Bromide	— lb.	— oz.	$1\frac{1}{2}$ dr.	NaBr	12	cc. tenthnormal
Aluminum Chloride	— "	— "	$\frac{3}{16}$ "	$AlCl_3$	1.5	" "
Ammonium Chloride	— "	— "	5 "	NH_4Cl	4	" "
Potassium Chloride	— "	3 "	3 "	KCl	40.5	" normal
Lithium Chloride	— "	— "	$\frac{1}{16}$ "	LiCl	0.5	" tenthnormal
Magnesium Chloride	1 "	2 "	$10\frac{5}{8}$ "	$MgCl_2$	120	" doublenormal
Sodium Chloride	7 "	15 "	1 "	NaCl	813	" "
Iron Sulphate	— "	— "	$2\frac{3}{8}$ "	$FeSO_4$	1.9	" normal
Manganese Sulphate	— "	— "	$\frac{1}{4}$ "	$MnSO_4$	0.1	" "
Sodium Sulphate	— "	1 "	13 "	Na_2SO_4	11.6	" doublenormal
Sodium Carbonate	2 "	6 "	$6\frac{1}{8}$ "	Na_2CO_3	41	" "
Sodium Phosphate	— "	— "	$\frac{1}{8}$ "	Na_2HPO_4	1	" tenthnormal
Sodium Arsenate	— "	— "	$\frac{1}{16}$ "	Na_3AsO_3	0.5	" "
Sodium Silicate	— "	2 "	$4\frac{9}{16}$ "	Na_2SiO_3	29	" normal
	10 lb.					

26. Wildungen, Georg-Victor Brunnen

Salt Mixture: (2½ dr. per gallon = ⅛ dr. per glass.)

Normal Solutions: (For 10 gallons.)

Ammonium Chloride	– lb.	– oz.	2¾ dr.	NH_4Cl	4 cc. tenthnormal
Barium Chloride	– "	– "	⅝ "	$BaCl_2$	0.8 " "
Calcium Chloride	– "	– "	15 "	$CaCl_2$	0.9 " doublenormal
Iron Sulphate	– "	8 "	3 "	$FeSO_4$	7 " normal
Potassium Sulphate	– "	1 "	11⅜ "	K_2SO_4	33 " "
Manganese Sulphate	– "	– "	6¼ "	$MnSO_4$	0.8 " "
Sodium Sulphate	– "	7 "	– "	Na_2SO_4	7.5 " doublenormal
Sodium Carbonate	– "	4 "	12 "	Na_2CO_3	4.5 " "
Sodium Silicate	– "	6 "	– "	Na_2SiO_3	13 " normal
Calcium Carbonate	5 "	5 "	– "		= 6 dr. dry calcium carbonate
Magnesium Carbonate	3 "	2 "	13 "		= 10¼ dr. dry magnesium carbonate.
	10 lb.				

27. Wildungen, Helenen Spring

Salt Mixture: (8 dr. for 1 gallon = ½ dr. per glass.)

Normal Solutions: (For 10 gallons.)

Ammonium Chloride	– lb.	– oz.	5 dr.	NH_4Cl	2.5 cc. tenthnormal
Barium Chloride	– "	– "	⅞ "	$BaCl_2$	1.8 " "
Calcium Chloride	3 "	5 "	– "	$CaCl_2$	212 " doublenormal
Potassium Chloride	– "	– "	3⅛ "	KCl	1.6 " normal
Magnesium Chloride	– "	– "	2 "	$MgCl_2$	0.5 " doublenormal
Iron Sulphate	– "	– "	15½ "	$FeSO_4$	8 " normal
Potassium Sulphate	– "	1 "	3¼ "	K_2SO_4	9.6 " "
Manganese Sulphate	– "	– "	1 "	$MnSO_4$	0.5 " normal
Sodium Carbonate	4 "	6 "	9 "	Na_2CO_3	284 " doublenormal
Sodium Silicate	– "	3 "	4½ "	Na_2SiO_3	26 " normal
Magnesium Carbonate	1 "	14 "	4 "		= 15 dr. dry magnesium carbonate.
	10 lb.				

C. Medicinal Waters and Similar Preparations

1. Acid Effervescent Waters, by Jacobsen

The various acids are weighed, filled into the 12-oz. bottles, dissolved in a few cubic centimeters of water if necessary, and the bottles then filled with saturated carbonic-acid water.

(*a*) *Citric Acid* crystals, $\frac{3}{16}$ dr. per bottle.
(*b*) *Phosphoric Acid* (25%), $\frac{9}{16}$ dr. per bottle.
(*c*) *Citro-phosphoric Acid:*

$\left.\begin{array}{l}\text{Phosphoric Acid (25\%), } \frac{1}{2} \text{ dr.}\\ \text{Citric Acid, cryst., } \frac{1}{8} \text{ dr.}\end{array}\right\}$ per bottle.

(*d*) *Hydrochloric Acid* (25%), $\frac{7}{16}$ dr. per bottle.

2. Effervescent Waters, by Jaworski

(a) Alkaline Effervescent Water

(Salts for 10 gallons.)

	Mild	Stronger
Sodium Bicarbonate	8 oz. – dr.	13 oz.
Sodium Salicylate	3 " 3 "	4 "
Sodium Biborate (Borax)	1 " 9½ "	3 " 3 dr.

(b) Effervescent Magnesia Water

(For 10 gallons.)

Magnesium Carbonate	8 oz. 6 dr.
Salicylic Acid	1 " $7\frac{7}{16}$ "

Dissolve the acid in hot water and add the carbonate.

3. Effervescent Salts

(a) General Employment

For 1 lb. of any mineral-water-salt mixture use additionally

Sodium Bicarbonate	9 oz.
Tartaric Acid	8 "

or, a mixture of

Citric Acid	4 oz.
Tartaric Acid	5 "

(b) Effervescent Bromide Salt

Potassium Bromide	2 oz. $2\frac{1}{8}$ dr.
Sodium Bromide	2 " $2\frac{1}{8}$ "
Ammonium Bromide	1 " $1\frac{1}{16}$ "
Sodium Bicarbonate	5 " $5\frac{5}{16}$ "
Citric Acid	2 " $\frac{7}{8}$ "
Tartaric Acid	2 " 6 "
Sugar, finely powdered	–" 14 "
	1 lb.

If the powder is to be granulated, mix 1 lb. of it with about 2½ ounces of absolute alcohol to form a paste, then press through a coarse sieve and then dry at a temperature of not over 100° F. When dried, sift off the powder, mix this again with some alcohol, and treat in the same manner as before.

(c) Effervescent Bromide-Iron Salt

Add to the above salt mixture for Bromide Salt

Iron and Sodium Phosphate, 14 dr. per lb.

Granulate, if required, in the manner already described.

(d) *Effervescent Lithium Salt*

Lithium Carbonate	– oz.	12¾ dr.
Sodium Bicarbonate	8 "	1¼ "
Citric Acid	2 "	14 "
Tartaric Acid	4 "	4 "
	1 lb.	

Granulate in the manner above described.

(e) *Effervescent Magnesium Citrate*

Magnesium Carbonate	1 oz.	12 dr.
Citric Acid	6 "	6 "
Distilled Water		12 "

Allow to dry at a temperature not exceeding 100° F. Add now

Sodium Bicarbonate	4 oz.	2 dr.
Citric Acid	2 "	8 "
Sugar, finely powdered	1 "	4 "
	1 lb.	

Granulate as above described.

4. Medicinal Effervescent Waters, by Jaworski

Any medicinal substance can be adapted to be taken as a medicinal water. The salts required for such a water are similar to those present in blood serum, which contains about the following:

0.2% Potassium Sulphate	(K_2SO_4)	
0.3% Potassium Chloride	(KCl)	
5.5% Sodium Chloride	($NaCl$)	
0.7% Sodium Phosphate	(Na_2HPO_4)	
3 % Sodium Carbonate	(Na_2CO_3)	= 4.74% sodium bicarbonate
0.3% Magnesium Carbonate	($MgCO_3$)	= 0.53% magnesium bicarbonate

The following solution is the equivalent of the above:

	Anhydrous Salts: (For 10 gallons.)			Normal Solutions: (For 1 gallon.)	
Potassium Sulphate	– lb.	3 oz.	2$\frac{11}{16}$ dr.	K_2SO_4	81.3 cc. normal
Potassium Chloride	– "	4 "	12$\frac{1}{8}$ "	KCl	121.6 " "
Sodium Chloride	5 "	8 "	12¼ "	$NaCl$	1136 " double-normal
Sodium Phosphate	– "	11 "	2 "	Na_2HPO_4	284.6 " normal
Sodium Carbonate	2 "	15 "	6$\frac{9}{16}$ "	Na_2CO_3	608 " double-normal
Magnesium Carbonate	– "	4 "	12¼ "	13$\frac{5}{8}$ dr. dry $MgCO_2$	
Carbonated water		about 9 gal.		sufficient carbonated water to	
To make		10 gallons		make 1 gallon	

This affords a salt content of about 10%, and the solution is called "Normal"; the dilutions may be *halfnormal*, *one-third-normal*, etc., and then contain the correspondingly smaller quantities of salts, the dilutions being made with carbonated water.

A differentiation is to be made between *Mineral Medicinal Waters*, which contain only inorganic salts, and *Organic Medicinal Waters*, which contain organic besides inorganic salts. The medicinal effect of the inorganic or organic salts is believed to be improved by the normal salts, which promote the absorbability and improve the taste. The concentration of the solutions should always be varied according to the pathological condition of the patient. Regarding the labeling of such medicinal waters, only their chemical constituents should be expressed, and it should never be represented as a specific or proprietary secret remedy.

5. Various Medicinal Waters

(a) Arsenic Water

Salts for 10 gallons:				Normal Solutions for 10 gallons:		
Potassium Chloride	— oz.	$2\frac{1}{2}$ dr.	=	KCl	40 cc.	normal
Sodium Chloride	— "	10 "		$NaCl$	80 "	doublenormal
Sodium Phosphate	— "	11 "		N_2HPO_4	176 "	normal
Sodium Carbonate	2 "	12 "		Na_2CO_3	272 "	doublenormal
Arsenous Acid	— "	$\frac{1}{4}$ "		As_2O_3	40 "	tenthnormal

(b) Bromide Water

(For 10 gallons.)

	(a) $\frac{1}{2}$ *normal.*	(b) *Normal.*
Sodium Bromide ($NaBr$)	6 oz. 6 dr. = 1632 cc. normal	14 oz. 6 dr. = 3680 cc. normal
Sodium Phosphate (Na_2HPO_4)	— oz. 11 dr. = 176 cc. normal	— " 11 " = 176 " "
Sodium Carbonate (Na_2CO_3)	1 oz. 2 dr. = 144 cc. doublenormal	1 " 2 " = 144 " doublenormal

(c) Iron Water

(For 10 gallons.)

Magnesium Chloride	— oz.	$8\frac{5}{8}$ dr.	= $MgCl_2$	69 cc.	doublenormal
Sodium Chloride	— "	2 "	= $NaCl$	16 "	"
Sodium Sulphate	— "	$12\frac{3}{4}$ "	= Na_2SO_4	102 "	"
Sodium Carbonate	1 "	$5\frac{1}{4}$ "	= Na_2CO_3	170 "	"
Sodium Phosphate	1 "	2 "	= Na_2HPO_4	288 "	normal
Ferro-sodium Pyrophosphate	1 "	$13\frac{1}{2}$ "	= Sodium Pyrophosphate	468 "	"

(*d*) Iodine Water

(For 10 gallons.)

Potassium Chloride	— oz.	2½ dr.	= KCl	40 cc.	normal
Sodium Chloride	— "	10 "	= NaCl	80 "	doublenormal
Sodium Iodide	3 "	6 "	= NaI	864 "	normal
Sodium Carbonate	1 "	12 "	= Na_2CO_3	224 "	doublenormal
Sodium Phosphate	— "	6⅝ "	= Na_2HPO_4	106 "	normal

(*e*) Lithia Water

(For 10 gallons.)

Potassium Chloride	2 oz.	3½ dr.	= KCl	40 cc.	normal
Sodium Chloride	1 "	7 "	= NaCl	184 "	doublenormal
Sodium Carbonate	2 "	14 "	= Na_2CO_3	368 "	"
Lithium Carbonate	2 "	14 "	= 2 oz. 14 dr. as dry substance; the solubility of this salt is limited.		

(*f*) Lithia-Soda Water

(For 10 gallons.)

Lithium Chloride	5 oz.	6 5/16 dr.	= LiCl	1381 cc.	normal
Sodium Carbonate	9 "	— "	= Na_2CO_3	548 "	doublenormal

(*g*) Magnesia Water

(For 10 gallons.)

Potassium Chloride	— oz.	2½ dr.	= KCl	40 cc.	normal
Sodium Chloride	— "	7½ "	= NaCl	60 "	doublenormal
Potassium Sulphate	— "	2½ "	= K_2SO_4	40 "	normal
Sodium Sulphate	11 "	14½ "	= Na_2SO_4	1524 "	doublenormal
Magnesium Carbonate	11 "	— "	= 11 oz. dry $MgCO_2$		

(*h*) Silica-Calcium-Iron Water

(For 10 gallons.)

Calcium Chloride	— oz.	7⅝ dr.	= $CaCl_2$	61 cc.	doublenormal
Iron Sulphate	— "	½ "	= $FeSO_4$	8 "	normal
Magnesium Sulphate	— "	9 "	= $MgSO_4$	72 "	doublenormal
Sodium Sulphate	1 "	6 "	= Na_2SO_4	176 "	"
Sulphuric Acid	— "	7 "	= H_2SO_4	112 "	normal
Sodium Silicate	6 "	6 "	= Na_2SiO_3	1632 "	"
Calcium Carbonate	1 "	7 "	= as dry $CaCO_3$		

(*i*) Urosin-Calcium-Iron Water

Calcium Chloride	— oz.	7⅝ dr.	= $CaCl_2$	61 cc.	doublenormal
Iron Sulphate	— "	½ "	= $FeSO_4$	8 "	normal
Magnesium Sulphate	— "	9 "	= $MgSO_4$	72 "	doublenormal
Sodium Sulphate	1 "	6 "	= Na_2SO_4	176 "	"
Sulphuric Acid	— oz.	7 dr.	= H_2SO_4	112 cc.	normal
Sodium Silicate	— "	¼ "	= Na_2SiO_3	4 "	"
Urosin (Lithium Quinate)	6 "	6 "	= as dry Urosin.		

6. Saccharin Lemonades for Diabetics

Dissolve 2 oz. 6 dr. saccharin and 1½ lb. citric acid in 2 lb. distilled water and make up to ½ gallon. *Employment:* ½ gallon solution for 10 gallons saturated carbonated water.

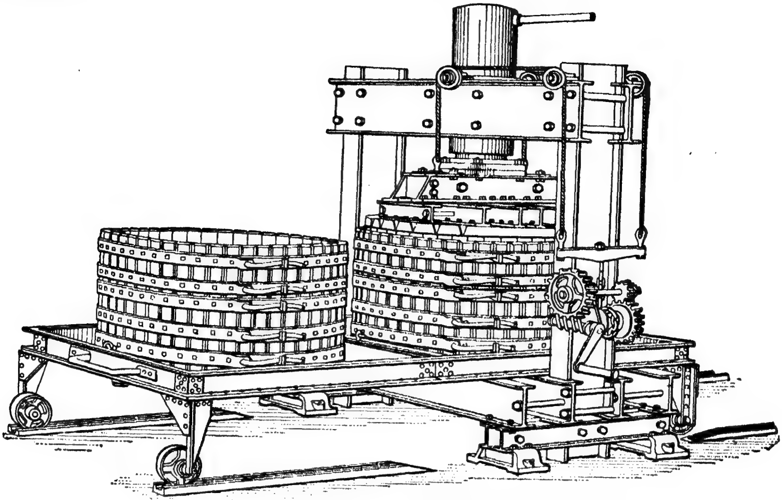


Fig. 20. Hydraulic press with double press cases.

II. THE FRUIT-JUICE INDUSTRY

Constituents of the Fruits and Fruit Juices

Fruits contain up to 75% water holding a number of substances in solution, and also undissolved matter consisting chiefly of cellulose and inorganic substances which promote the growth of the plant, particularly calcium salts and silicic acid. Some of the soluble substances are of less interest, *e.g.*, coloring matters, while some are important, as sugar and fruit acids; and these are always accompanied by other carbohydrates, as starch, gum, mucilaginous substances, pectin, albumin, etc.

Sugar is contained in every fruit, but in different amount, and it is formed by the transformation of starch during the period of ripening. The sugar is mostly dextrose (invert-sugar, starch-sugar) and fruit sugar (levulose), which are directly fermentable. Some starch is always to be found in many ripe fruits. Stone fruits contain gum and various mucilaginous matters, while pectin (plant-jelly) is present in large quantity in kernel fruits. The latter substances are of but little value, and so also is the plant-

albumin. More important is the content of acids. These exist in various quantities as citric, tartaric and malic acids. They are nearly equally acid, and without any by-taste. Unripe fruits contain most acid, while most sugar is found in ripe fruits, and the proportions between both constituents are important for the taste of the fruit and its refreshing properties.

Besides these fruit acids some other acids are to be found, which are in a certain sense to be considered as preservatives, as benzoic, boric and salicylic acids. In stone fruits hydrocyanic acid is developed, which gives the taste of bitter almonds. Many fruits contain tannic acid, which gives an astringent taste. Other less important constituents are the mineral salts, usually the chlorides, sulphates, phosphates, etc., of potassium and sodium, some iron, and other soluble inorganic salts, which are usually designated as "nutritive salts," but the value of which is very much overrated.

The most important constituent is the fruit acid, and the value of the juice largely depends upon the content and the strength of the acid. The natural coloring matter is very sensitive to alkalies, and is stable in acid solution. Albumin is found in all fruit juices. It is partly coagulated at 158 to 180° F. It constitutes the foam when syrups are boiled. Pectin is only valuable for making jellies and marmalades because of its property of swelling.

These constituents are present in varying proportions in all fruit juices. The distinguishing feature in all is the characteristic fruit flavor. The flavor alone gives the fruit its pleasant taste, which in turn is improved by the proportions of acid and sugar present. The taste is more developed in acid fruits, but becomes usefully evident when the acid taste is corrected by the addition of sugar. Hence the flavor of the natural juices first becomes of value when the juices are sweetened sufficiently. The nature of the flavor is not fully known. Only in citrus fruits, as lemons, oranges, etc., is it present in large quantities as volatile oil, the flavoring constituent of which can be isolated. The flavoring substances have much similarity with the volatile oils, and very probably they, too, consist of alcohols, esters, ketones and similar organic aromatic substances, although only in such small quantities that they cannot be isolated in absolutely pure form as can be done with the taste-carriers of the oils.

At all events, however, the flavoring can be transferred to essences, as described in the manufacture of fruit essences. The

aroma is elaborated during the ripening of the fruit, and is formed to greatest extent when the fruit is fully exposed to sunlight. It disappears when the fruit becomes soft or overripe. When covered with a coating of wax the fruit keeps better, and frequently the flavor then develops only on keeping. The flavor is very sensitive to fermentation processes. These alter the flavor in various ways. In some cases the flavor is deteriorated, in others it is increased. This change is due to the fact that the finer flavoring substances in particular often disappear and pass over into a general taste, or that some other flavors are formed which also alter the taste.

The most sensitive are the flavors of strawberry, pineapple and banana, and less so, those of peaches and apricots, while those of raspberry, gooseberry and some other berries are but slightly sensitive. The taste is more developed by fermentation of apples, pears, all stone fruits, and particularly black currants, which develop a taste quite different from that of the fresh fruit. On the other hand the flavor is influenced by heat, and at a temperature above 160° F. there is often developed a "boiled" taste. The following table shows the average percentage composition of the fruits:

(a) AVERAGE PERCENTAGE COMPOSITION OF FRUITS

Fruit.	Substances		Water.	Sugar.	Acid.	Mineral substances.	Pectose.	Juice yield.
	Insoluble.	Soluble.						
								%
Agriots	6.630	12 880	80 490	8.77	1 277	0 652	0.246	65–75
Apple, Canadian	2 460	15.340	82 200	5.96	0 390	0.220	2.700	......
Apple, for cider	2 950	11.450	86 000	7 81	0.380	0 170	2.040	......
Apple, winter fruit	4 010	10.160	85.830	7.58	1 040	0.440	1.700	......
Apple, average	2 760	12.250	84.740	7 46	0 820	0 320	3.900	55–75
Apricot	9.120	5 920	84 960	1.14	0 890	0 820	5 870	......
Bilberry	12.865	9 583	77.552	1 34	0.858	0.256	0.256	65–75
Blackberry	5.494	8 100	86 406	4.44	1 180	0 414	1.420	75–82
Cherry, light-red	5.930	20 700	73 370	13.51	0 350	0.690	1.450	......
Cherry, dark-red	6.400	13.100	79.700	10.77	0 56	0.678	0.664	65–75
Currents, black	3.490	11.152	85 355	5 65	1.650	0.°20	2.380	64–76
Currants, red	4.480	10 250	85.270	6.44	1 840	0.570	0.720	78–82
Currants, white	4.850	11.730	83 420	7.12	2.530	0.700	0.510	67–75
Gooseberry, red	3.000	11.435	85.565	8.06	1.358	0.317	0.294	65–76
Gooseberry, yellow	4.835	9.801	85.364	7.50	1.334	0.277	1.955	......
Grapes	4.740	15.290	79.970	13.78	1.020	0.369	0.490	65–78
Mirabelles	6.549	11.215	82.236	3 58	0.582	0.570	1.080	......
Peaches	5.615	9.385	85 000	1 58	0.612	0.422	0.642	......
Pears	6.531	13.450	80.200	0.26	0.580	0.280	3.010	63–77
Plums	5.330	12.540	81.930	5 79	0.952	0.734	0.630	......
Raspberry, wild fruit	8.640	7.480	83.860	3.59	1.980	0.227	0.180	65–80
Raspberry, garden fruit	4.608	8.835	86.557	4.70	1.365	0.481	0.502	65–80
Green Gages	4.887	.5 393	79.720	3.40	0.870	0.398	0.245	......
Strawberry, garden fruit	1.960	10.566	87.474	7 57	1.130	0.480	0.900	70–84
Strawberry, wild fruit	6.032	6.697	87.271	3.24	1.650	0.737	0.299	......

(*b*) Fruit Juices: Content of Sugar and Acid, Possibility of Concentration, and Kinds of Fruit Acids and Accompanying Acids.

Fruit.	% sugar.			% acid.*			Possibility of concentration	Acids present.†
	Minimum.	Maximum.	Average.	Minimum.	Maximum	Average.	Times.	
Agriots	7.3	13.5	8.77	.....	....	1.28	6	Ma-(Cy)
Apple	5.1	24.0	8 37	0.3	0.8	0 75	6	Ma-(Bo, Sy)
Apricot	.....	.....	1.08	.....	...	1 09	20	Ma-Ci(Sy, Cy)
Barberry	...	....	2.40	....	...	1 10	20	Ma
Bilberry	4 4	7.8	7 78	1 0	1 6	1.34	8	Ma-Ci
Blackberry	4 4	7.2	4 74	0.8	1 8	1 19	10	Ma-Ci(Sy)
Cherry, sweet	7 3	13 5	10.79	0.3	1.3	0 63	6	Ma-(Cy)
Cranberry	...	....	6 50	....	..	2.20	10	Ci-Ta(Bz)
Currants, black	...	....	6.10	1 8	4 8	2 40	8	Ma-Ci(Sy)
Currants, red	7.3	16.9	13.50	....	..	2.40	8	Ma-Ci-Ta(Sy)
Elderberry	.....	....	9 50	....	...	0.40	6	Ma-Ci
Gooseberry	5.1	8 3	7 15	0 8	2.1	1 45	6	Ma-Ci-Ta
Grapes	12 0	25.0	14 93	0 6	1.2	0.74	4	Ma-Ta(Bo, Sy)
Lemon	2.5	10 0	3 5	4.5	8.0	7 00	6	Ci
Mandarins	.....	.....	14.0	.....	...	2 5	5	Ci
Mirabelles	.....	.....	3 58	.....	.	0 58	12	Ma(Bo, Sy, Cy)
Mossberry	.....	.....	8.50	.....	.	2 20	6	Ci, Ta(Bz)
Mulberry	.....	.....	9 20	.....	...	1 86	6	Ma
Orange, sweet	.....	.....	15 00	.....	..	2 50	4	Ci
Orange, bitter	.....	....	12.00	.....	....	3.50	4	Ci
Pears	6.3	15.5	7.45	.....	....	0 07	6	Ma(Bo)
Peaches	.....	.....	1 57	.....	...	0.67	20	Ci(Sy, Cy)
Pineapple	....	....	9 65	.....	...	0 90	6	Ci
Plums	4.8	11 6	6.25	0 4	1.6	0.89	10	Ma(Bo, Sy, Cy)
Pomegranate	.....	.....	15 00	...	..	0 40	4	Ma-Ci
Quinces	....	.....	6 30	....	...	4 50	6	Ma(Cy)
Green Gages	.....	.....	3 12	....	....	0.91	10	Ma(Bo, Sy, Cy)
Sloes	....	.....	6 25	.....	....	0.89	10	Ma(Bo, Sy, Cy)
Sorbberry	.....	.....	6 50	...	....	0.65	10	Ma-Ci(Sy)
Strawberry	4 3	8.2	5 73	0 8	1.6	1.37	10	Ci(Sy)
Tomatoes	...	.....	4 50	...	...	0 40	15	Ma

* The acid percentage is calculated as malic acid. *Obs.* The abbreviations referring to the acids present are as follows:

† *Fruit acids:* Ma=malic acid, Ci=citric acid, Ta=tartaric acid.
Other acids: Bo=boric acid, Bz=benzoic acid, Sy=salicylic acid and Cy=hydrocyanic acid.

MANUFACTURE OF FRUIT JUICES

Regard must be had as to whether the fruits are to be fermented or whether they are to be worked in the fresh state. In cases where fermentation impairs the aroma, the fruits must be employed as fresh as possible. They must be fully ripe, but not too ripe, and all bad or bruised fruit must be removed, as also the stalks of the single fruits or from the bunches of grapes, and of course also leaves and other impurities that might influence the taste and make it harsh.

According to the nature of the fruits, they may be washed,

if they are provided with a substantial peel, but the soft fruits, as raspberries, strawberries, etc., must not be washed, because the juice would be diluted with the water. These soft fruits need also not be crushed, this being necessary only with fruits with a substantial skin. The crushing is to be done in special fruit-mills provided with stone rollers, because the fruits must not come into contact with iron or other metal which would influence the color of the juice and also the taste. The more completely the fruits are crushed, the easier the pressing, and the larger the quantity of juice obtained.

If fruits are to be fermented, perhaps to develop a certain taste, or to follow the requirements of the Pharmacopœia, it is useful to crush the fruits to hasten the manipulation. The fruits contain naturally various yeasts, which induce fermentation. A temperature of 72 to 86° F. favors the completion of the fermentation in about 5 to 7 days. To support the fermentation or to increase the development of alcohol, it is usual to add to the mash about 2 to 5% of sugar which, after inversion by the fruit acids, is then fermented. The alcohol developed improves also the flavor, because even so small a quantity as 3 to 6% of alcohol promotes a better solution of the flavoring present in the cells. The alcohol has the further effect to coagulate albumin and pectin, which precipitate in insoluble form and not only clear the juice, but facilitate the filtration later on. To recognize the completion of the fermentation, filter off some juice, and mix equal parts of it and strong alcohol; after half an hour no precipitate should form, nor should the liquid become cloudy. If a reaction occurs, the pectins are still present, and the fermentation must be continued. The fermentation is effected in open vats. If it is desired to ferment the pressed juice alone, for example to facilitate filtration, use closed casks provided with a fermentation bung which allows no access of air, but allows the escape of the carbonic acid. To improve the flavor, however, it is better always to ferment the total mashed fruit. Usually, fermented fruits are more easily pressed because the cells are softened, and the yield of juice is larger. The figure at the head of this part shows a modern hydraulic press with 2 pressing cases, one of which may be emptied or filled, while the other is being pressed.

The presses are very varied in form, and most of them are suitable if they have no iron which can come into contact with

the fruit. The method of pressing is so simple and well known that it is not necessary to describe it fully. The quantity of juice obtained depends upon the power of the press and the condition of the fruit. The expressed juice is then ready for use. When it is used for syrups immediately after pressing it is necessary to clear the juice, or it must be preserved in some way, because the juice is not stable.

However, the fruits are not quite exhausted even with the best press. The residues retain a considerable quantity of liquid, which diminishes the yield to some extent. It is hence usual to stir the residue with an equal weight of water and allow the mixture to stand for an hour or two, when a new pressing affords a diluted juice containing a part of the juice retained by the residue. Frequently the juice and second pressing are mixed for the purpose of making a cheaper product, but this must be declared. The quantity of second pressing may vary, but it may be comparatively determined by an analysis of the content of mineral substances, the quantity of which is diminished, due to the water employed for the second pressing.

Juices with very little color are often mixed with other darker colored juices, as cherry or bilberry juice, but this manipulation must also be declared. The public often esteems a juice because of its color, and believes that the more highly colored the more valuable it is. The possibility of coloring is limited only to the use of other natural fruit juices, but, on the other hand, the employment of other fruit juices for this purpose is limited according to the taste of each juice, which would influence the natural taste of the juice to be colored.

The final operation in the manufacture of fruit juices is the clearing and storage. In most cases storage alone is sufficient to clear the juice, or at least to facilitate filtration. The latter requires a filter of glass, or at least of a resistant silvered metal. Other metals may impair the color, and may be dissolved by the acid. The filtration is facilitated by the use of asbestos, infusorial earth, talcum, etc. In many cases filtration is very difficult because of the content of albumin and pectin, and therefore fermented juices are more easily filtered than unfermented. The addition of about 0.5% of skimmed milk also facilitates the filtration. The best method is to clear the juices by long standing in casks, provided the juices are protected from spoiling. For

whatever use the fruit juices are to be put, it is a prime necessity that they be absolutely clear, because it is very troublesome later on to clear syrups or other preparations of fruit juices.

THE SPOILING OF FRUIT JUICES AND THE REMEDIES

As is well known, fruits contain considerable quantities of fermentible sugar. During fermentation, the sugar disappears more or less completely, partly because the fermentation is not quite complete, and hence more or less sugar remains in the juices. In non-fermented kinds the entire sugar is present, and since the fruits, and of course also the juices, are always infected with yeasts, fermentation takes place in the manufactured juice and spoils it. The development of alcohol continues the spoiling initiated by the bacteria, by the transformation of the alcohol formed into acetic acid, and the juices become sour and are then still less valuable.

There are several means for checking the action of the bacteria. The latter are living organisms, and to prevent their activity the conditions which favor their living must be interrupted. This can be done by killing them by means of heat, or by chemical means, or at least by means which inhibit the development of bacteria, the nutrient media upon which they live being made sterile.

The interruption can be effected with alcohol. Even though the alcohol results from the fermentation of sugar, the quantity formed is about 15% as the limit, and where more alcohol than this is formed, the alcohol is its own poison as to further development. The surest method is hence the addition of alcohol to fruit juices to the extent of about 15 to 16% by volume. Such juice is very well suited for alcoholic beverages, but not for lemonades in general, for which purpose most of the juices are employed. Besides the high price of the added alcohol, it would be superfluous, because the alcohol is not needed for the juices themselves, while it is undesirable for non-alcoholic beverages. Although the alcohol may be distilled off when the alcoholic juices are boiled with sugar to a fruit syrup, the trouble is that the sensitive aroma is driven off also with the alcohol, and the flavor of the juice is diminished. In view of these circumstances, the juices are best preserved by boiling with sugar to form a syrup, the more so as sugar is always used with the juices to sweeten them. Sugar to

the extent of about 60% abstracts from the juice as much water as is required for its solution, while at the same time the bacteria cannot live without water. They are not killed, but their activity is interrupted. The technical difficulty involved lies in the investment of much capital for sugar for a year's supply, and in that the clearing of the juice is very difficult in large quantities when the juice is too fresh. The simplest means would be chemical methods, in so far as these are harmless, but in this respect many disputes have arisen against the judgment of the physicians. Thus, the simple employment of *salicylic acid*, which has been used for decades in the household, is believed to be injurious, just as is the very convenient *formic acid*. Where in some countries its employment is allowed, of course with the proper declaration, the quantity is limited so that the single quantities are not likely to injure the health. For salicylic acid the limit is 0.05%, and for formic acid 0.25% as pure acid = 1% of the 25% formic acid. Regarding formic acid it is to be remembered that it is a volatile acid which distils off, at least partly, when the juice is boiled into syrup.

In some countries *benzoic acid* or sodium benzoate is allowed. The percentage allowed is 0.05% as benzoic acid, and this preservative must also be declared.* Good results are obtained by preserving juices with *hydrofluoric acid*. This is an antibacterial of considerable power, but not harmless enough; its advantage, however, is that it forms with calcium salts insoluble precipitates. When a juice preserved with hydrofluoric acid is used for any preparation for the open trade, the acid must be removed by precipitation with calcium carbonate, calcium fluoride being formed, of which only slight traces remain dissolved in the juice. Of course after this defluorization the juice is no longer sterile, but must be worked up at once. About 25 cc. hydrofluoric acid of 50 to 55% are required for 10 gallons, and for precipitation about 1¼ oz. of calcium carbonate is sufficient; after removing, the employment need not be declared. Great care must be taken that no juices preserved with hydrofluoric acid are marketed without removing it.

Because of the difficulties arising from the use of chemical means, there remains only *sterilization* of juices. It is remarkable that many of the manufacturers do not incline to this, the most

* In the United States the percentage allowed is 0.1%.

natural and least objectionable method, probably by reason of a certain distrustfulness which is due solely to negligent treatment. The bacteria are killed at a temperature above 180° F. It is necessary, however, to maintain this temperature for at least half an hour. The principle of sterilization or pasteurization is the heating of the juice to this temperature and keeping it there for about 20 minutes to half an hour. Many apparatus are constructed for this purpose, especially for the sterilization of liquids in bottles. For juices sometimes glass carboys, demijohns, etc., are employed. The sterilization itself is, however, only the first step for insuring stability, the most important circumstance being the prevention of an infection with new bacteria or yeasts and the absolute exclusion of air. Bottles or carboys, which receive the still hot sterilized juice must be closed at once with sterile stoppers, best also paraffined, and may then be kept for very long periods provided the exclusion of air is absolute. A further advantage of such heating is the coagulation at the same time of albumin, which is separated, whereby the clearing of the juice is better effected. On storage the precipitation of the constituents causing turbidity is now less difficult. For manufacturing on the large scale the employment of many small glass vessels is not practical, and therefore the following method of sterilization in casks is to be recommended: The casks to be used must be cleaned most carefully, and sulphurized immediately before filling. They must be provided with a cock for emptying, and they must be fully dry outside. The juice is sterilized in usual way by heating in a vessel at 180° F., and allowed to stand half an hour at this temperature, but the temperature must not exceed this degree because otherwise the taste may be impaired. As the flavor is volatile, and its volatility would be increased by the small quantity of alcohol present which is unavoidable, it is advisable, while heating, to close the vessel with a cover cooled with water so as to condense the vapors formed on heating the juice. In this way no flavor is lost, and the juice retains its full value. After sterilization the hot juice is run into the prepared casks which are then closed with a bung bearing a Pasteur stopper. A more simple contrivance is a small glass funnel bearing a glass stopper. The lower part of the stem bears a glass cock, and is fixed in the perforated bung so as to reach inside the cask, but not to the surface of the liquid. The casks, however, are filled

up as much as possible, only a little room being left over the surface of the liquid. The part of the funnel above the cock is filled with a sterile cotton plug, the hole being closed with the stopper. After allowing the filled cask to stand for about a day to cool, it must be varnished over with hot liquid paraffin, which closes all pores of the cask. In particular the cock for emptying and the bung itself must be covered with sufficient paraffin to prevent entrance of any air from without. It is still more to be recommended to float on the surface of the still hot contents of the cask, and before closing with the bung, a thin layer of liquid paraffin, say about 100 cc. for a content of about 200 gallons, or somewhat more for larger casks; the oil prevents all contact of air with the surface of the liquid. Those parts of the cask in contact with the layer are paraffined first, and then the cask is set on end and the paraffining finished. This method is suited for the largest sizes of casks, and if carefully managed, is durable for any length of time. Underneath this layer the juice clears itself by precipitation of the cloudy constituents. When the juice is to be emptied, it is first necessary to open the two cocks of the closure so that the air necessary for emptying must pass through the sterile cotton plug and thus get into the cask free from bacteria. The clear juice is drawn off, and any remainder must be filtered as usual. The thin layer of liquid paraffin on the surface is carefully removed, and the juice immediately used up because the conditions favoring its durability no longer exist. If only partly emptied, the cocks are closed again, and the remainder may stand for a long time in quite the same sterile condition.

NATURAL FRUIT SYRUPS

In general 13 parts of sugar are boiled with 7 parts of juice, and when dissolved, the syrup is filtered through flannel to remove the albumin, which separates as a foam. Finally the product must be weighed, and the unavoidable loss of water is to be made up by adding enough water to yield 20 parts of syrup.

The boiled syrup may be filtered through flannel, which suffices when the juice employed is clear.

It is usual to heat the sugar and the juice with constant stirring, and only when the sugar is nearly dissolved is the mass brought to a boil. It is sufficient if the syrup boils up only once. The length of time of boiling should be shortened to avoid inversion.

The cane sugar is inverted by means of the fruit acid of the juice, but mostly at the boiling temperature, and the result of this action is the recrystallization of the syrups, because the dextrose formed is less soluble and hence more likely to crystallize at a lower temperature. It is also advisable to cool the syrup after boiling, for the same reason.

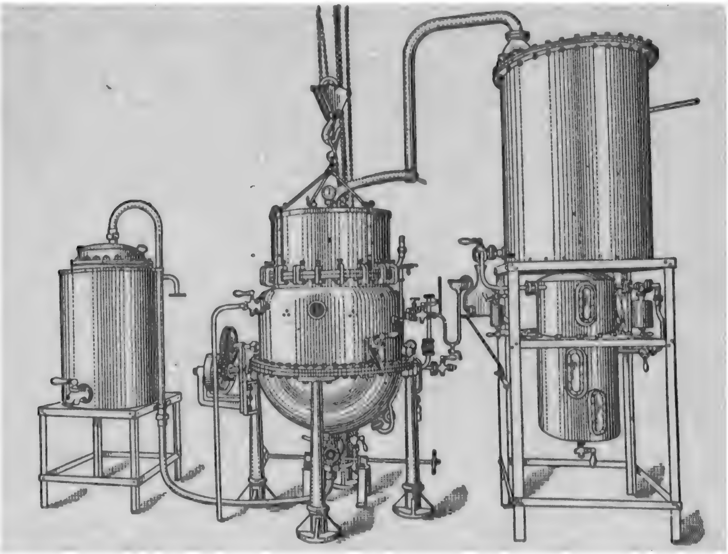


FIG. 21. Vacuum apparatus suited for fruit syrups, with mechanical stirrer, cooler on the cover of the still, and special cooler after filtration of the hot syrup by atmospheric pressure directly from the still by the vacuum pump, installed as pressure pump. Suited also for concentrating fruit juices and for the manufacture of jams.

The most rational method is the boiling of fruit syrups in a vacuum. The juice is heated somewhat and mixed with the sugar by mechanical stirring, and then boiled up at about 135° F. It is only necessary to heat to the temperature of about 160 to 170° F. to coagulate the albumin, but this is done without a vacuum. The advantage is the operation at a considerably lower temperature, since a higher temperature impairs the fineness of the flavor. Another fact to be observed is that with the vapors of the fruit juice a great deal of flavor disappears if the boiling is prolonged too much. It is better to boil in a still where the vapors can be recovered as a liquid, which, as an aromatic constituent, may be

added again to the syrup. Vats too should be closed with a cover which should be made to act as a condenser, so that the vapors are returned as a liquid to the vat and thus occasion no loss of liquid, and, particularly, of flavor.

CONCENTRATION OF FRUIT JUICES

The juices contain rather large quantities of water, and only small quantities of extractives, and to gain the latter, which alone are desirable, it is only necessary to distil off the water, best in a vacuum. As is well known, the flavor is much impaired by heat, and the more so the longer the juice is heated, but at a temperature of say about 113° F., the flavor will not be affected to any great extent. However, the volatile flavor will distil off, and the greater part will be obtained in the first 10% of distillate. Therefore it is usual to first collect this 10%, which is reserved, and then to distil off as much as is required to afford a concentrated juice. In the table, p. 138, giving the content of acids and sugar in fruits, there will be found a column giving the concentration to which the juice may be brought. As an example, the manufacture of concentrated cherry juice will be explained. The possibility of concentration is about 6 times. From 100 gallons of juice collect 10 gallons of first distillate, containing the whole flavor. Distil off now about 75 gallons water which are of no value, and reserve the residue. Repeat this operation 4 times with 100 gallons each time, and collect in all 50 gallons of first aromatic distillate which rectify slowly for concentration purposes to 10 gallons only, and which will contain the whole flavor of the 500 gallons juice employed. On the other hand, we obtain as a residue 5 times about 15 gallons, = 75 gallons in all. Mix this with the 10 gallons flavor. The result will be 85 gallons, that is about the sixth part of the juice employed, and the juice will then be concentrated about six-fold. This must be filtered, because it is necessary that the juice diluted with 5 parts of water affords a quite clear solution corresponding physically to the original juice. As the filtration is often very difficult, the following method may be employed, which permits the raw juice to be used without previous clearing. As before, collect 10 gallons of aromatic rectified distillate separately, and 75 gallons extract. Cool the latter and mix with an equal volume of strong alcohol which will precipitate pectin, albumin and also salts not soluble in strong alcohol, but

which will not affect the taste. The liquid is allowed to settle, and the clear portion filtered off from the residue, introduced into the still, and the alcohol distilled off. The final extractive residue in the still is mixed as before with the concentrated flavor. and the result is a clear concentrated juice suited for export; and as it is perfectly stable, it will serve for making preparations of the fruit juices.

NATURAL LEMONADES AND FRESH-FRUIT BEVERAGES

The recognized advantages of natural fruit juices, which may be called "fluid fruits," make them suited for preparing refreshing drinks. An objection, however, is the low durability of the juices, and the fruit syrups alone are not always adapted to afford an excellent drink because they vary greatly regarding their acidity. To obtain a taste that will be agreeable to everyone it is necessary that a certain relationship exists between the proportion of sugar and acid. The effervescent artificial lemonades remain in good condition when on an average the content of sugar is about 60 times greater than that of the acid, and then only is the flavor freely in evidence. The quantity of acids in our fruit syrups is on an average insufficient, and therefore the best fruit lemonades are prepared from the juice diluted with water and sweetened as desired.

Although the carbonated true fruit lemonades afford good non-alcoholic drinks when prepared in the manner described later, yet the fruit juice is very sensitive to the action of bacteria, and does not keep well but becomes cloudy in a short time, especially in the hot season, and spoils the lemonades. Therefore it is a prime requisite to sterilize the lemonades made from fresh fruits. The apparatus for sterilization in bottles is quite well known, but any method would suit in which the liquid is heated for about 20 minutes to from 180 to 190° F. and immediately stoppered. The juices employed must also be previously sterilized, and be quite clear.

The quantity of juice varies according to the different acids in the various fruits. In the table given later on, the quantity in cubic centimeters of juice needed for every 12-oz. bottle is delivered by means of a pipette or burette. Each bottle is filled with the quantity of juice stated, and as sugar is also important in the manufacture of lemonades, $1\frac{1}{2}$ oz. on the average of a 60%

sugar syrup is added to every 12-oz. bottle. Finally the bottles are filled up with the carbonated water and sterilized as usual.

Fresh-fruit beverages are similar to the natural fruit syrups, containing only sugar and natural fruit juice, but in different proportions, the acid being present in the proportion of 1 part acid to 60 parts of sugar on the average.

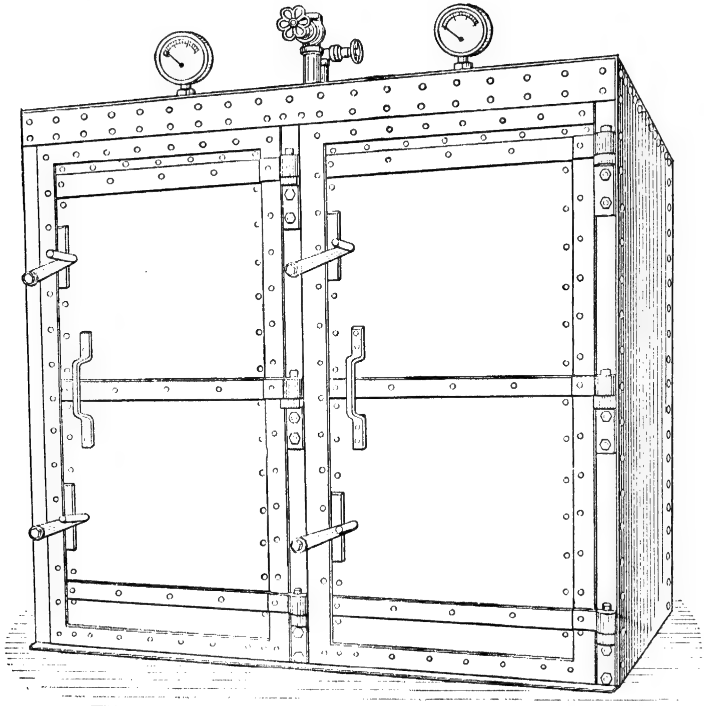


FIG. 22. Apparatus for pasteurizing beverages in bottles by means of steam.

These conditions, however, will not suffice to make the preparation durable, and therefore the beverages must also be sterilized in the bottles, and the consumers who use the beverages by diluting them with water, must use them soon, at least within a few days, and in the meantime must keep them well stoppered. The advantage is the possibility of having every kind of fruit always at hand. The flavor is protected from being impaired when the solution of sugar is made at the common temperature without boiling, which latter always injures the flavor in some way. The fresh-fruit beverages are suited for all lemonades

in the household, for restaurants and refreshment parlors, for bowls and puddings; they have the most pronounced natural taste of the fruit, and possess some medicinal value because of the fruit acid and nutritive salts they contain. They also afford the enjoyment of fresh fruits at periods when such are not at hand. The only trouble is the necessity of sterilizing the bottles. On account of the variation in the content of sugar, every bottle should bear a label stating the amount of water to be added to obtain a fresh lemonade.

One of the most important troubles is the irregularity of the acid content of the juices. The following tables give the average acidity of the juices. For the manufacturer it would be advisable to reduce their more or less acid juices to an average, because a regulated acidity would give unit results.

Employment of Natural Fruit Juices for Natural Lemonades and for Fresh-Fruit Beverages, and the Equivalent Quantities of Fresh Fruits in These Preparations

Kinds of fruits.	Average acidity of the juices.	Natural lemonades. A 12-oz. bottle contains		Fresh-fruit beverages. 1 gallon of the beverage contains			The beverage is to be diluted with water or carbonated water.
		Quantity of juice.	Equivalent quantity of fruits.	Sugar.	Juice.	Specific gravity.	
	%	Cc.	Oz. (abt.)	Lb.	Pints.		Times.
Agriots	1.3	30	1½	5¼	5½	1.200	5½
Apple	0.8	70	3½	5¼	5½	1.200	6
Apricot	1.1	35	1½	4¾	5⅝	1.180	5½
Bilberry	1.4	30	1½	5⅝	5¼	1.200	6½
Blackberry	1.2	35	1½	5¼	5½	1.200	6
Cherry, sweet	0.6	65	2½	2¾	6¾	1.110	4
Cranberry	2.2	25	1	6¼	6¼	1.240	7
Currant	2.4	25	1	6¼	6¼	1.240	7
Gooseberry	1.5	30	1¼	5⅞	6⅛	1.220	7
Grape	0.8	70	3½	3½	6	1.140	4½
Lemon	7.0	6	......	......	......	......	......
Mandarin	2.5	16	.....	7¼	4	1.200	......
Orange, sweet	2.5	16	......	7¼	4	1.200	......
Peach	0.7	60	3	3¼	6½	1.130	4
Pineapple	0.9	45	2½	4	6	1.160	5
Plum	0.9	45	2½	4	6	1.160	5
Pomegranate (Grenadine)	0.4	100	....	2¼	7	1.080	3
Raspberry	1.5	30	1½	5⅞	6⅛	1.220	7
Strawberry	1.4	30	1½	5⅝	5¼	1.200	6½

(*a*) *Natural Lemonades:* The numbers of cubic centimeters are to be understood to be for a 12-oz. bottle, and the equivalent

weight will give the weight of the fruit employed for this bottle. Besides the cubic centimeters of juice, every bottle contains $1\frac{1}{2}$ oz. sugar syrup of 60% sugar content. The bottles are to be filled with carbonated water and then sterilized as usual.

(*b*) *Fresh-Fruit Beverages:* The numbers give the quantity of sugar and juice necessary to obtain 1 gallon of the beverage. The last column gives the extent to which the beverage should be diluted by the consumer.

THE JUICES OF THE CITRUS FRUITS

The juice of the citrus fruits contains much citric acid, and but little flavor, because this is not soluble in the juice. A great deal

FIG. 23. Machine for peeling citrus fruits, in action.

of lemon juice is pressed in the countries where these fruits grow. Some also is pressed from imported fruits. The fruits are peeled by simple machines like those used to peel potatoes (see figures).

The peels are used to make essences, or in confectionery, for cakes, etc. One case of about 200 to 300 lemons yields about 11 lb. of peel suited for essence manufacture.

The juice is obtained not by expressing, as is the case with other juices, but by drilling with wooden electrically-driven tops

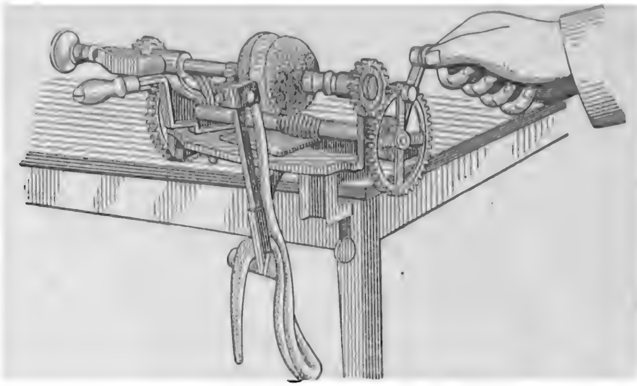


FIG. 24. Machine for peeling lemons.

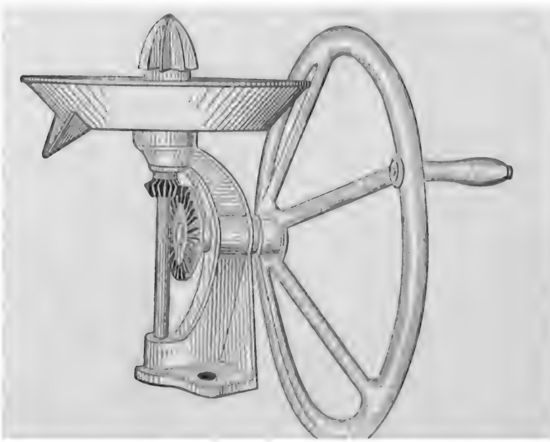


FIG. 25. Hand-machine for obtaining the juice of citrus fruits.

(see Figs. 25, 26 and 27), which carry the peeled fruits which have been cut in two. The juice is collected in enameled vats. The skins are used for cheap marmalades. The juice is cloudy and contains much fruit flesh, hence it must be passed through a horsehair sieve which holds back the fibers; it is now called lemon must. This is not very stable, but soon ferments, hence it must

be worked up with sugar into a syrup, or be preserved in some other manner. The liquid is very acid, but it acquires a peculiar taste when heated. Sterilization also somewhat affects the pure taste, and the same thing happens when lemon juice or must is boiled into a syrup. It is hence better to dissolve the sugar in the cold, using about 6 parts of sugar to 4 parts of juice. Of

FIG. 26. Hand-machines for obtaining the juice of citrus fruits, in action.

course this lemon-must syrup may not be filtered, and when later on it is mixed with water to afford a refreshing beverage, the latter will always be cloudy because it still contains fruit fibers.

Lemon Juice is nothing else but a filtered must, but it is very difficult to get a clear and good juice, having due regard to the taste. First and foremost, all metals must be kept from contact with the lemon juice, because they would influence the color as well as the taste. Then again it often contains bitter substances derived from the lemon peel, and these must be removed. Frequently too it is dark colored, from long standing, especially when exposed to the light. The coloring matters too must be removed, and this is done with freshly burnt charcoal, using about 1% well stirred with the liquid, and filtering through paper in a day or two with the aid of talcum, or better, infusorial earth or

asbestos, and using filters made of silver or of glass. The first portion of the filtrate will be cloudy, but soon the liquid passes clear. The clear juice should be received in a dark bottle for it becomes rapidly, often while filtering, dark and brownish. Also, before storing, it must always be bottled in dark or amber bottles.

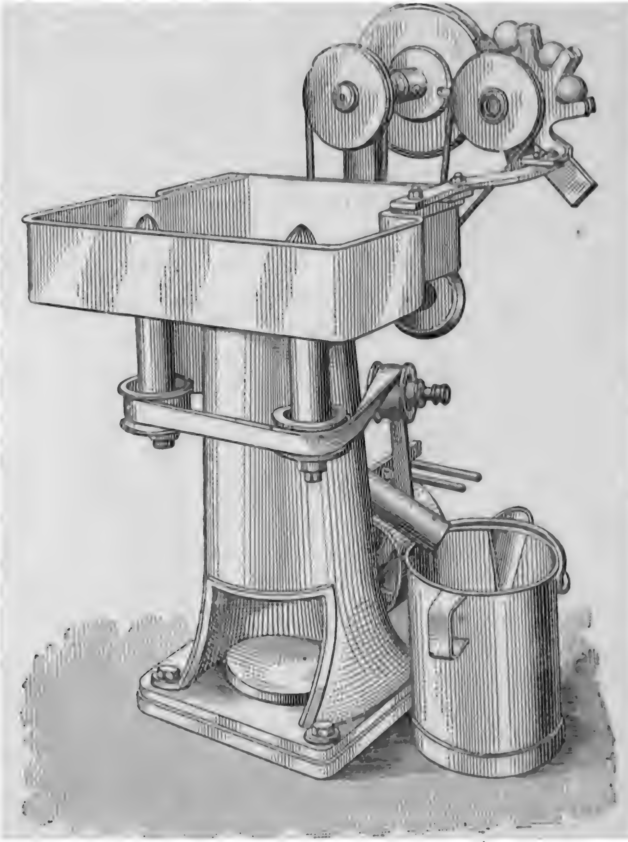


FIG. 27. Machine for obtaining lemon juice (drilling system).

After filtering it must be preserved in some way, or worked up into syrup, or better, 6 parts of sugar are dissolved by well stirring and at a low temperature, in 4 parts of the juice. This syrup is to be filtered. It is allowable to add to the lemon juice, must, or syrup, some genuine flavor made from the peel, for example soluble essence of lemon, sufficient to impart a satisfactory taste, because the juice alone has but very little taste.

In the same manner bitter or sweet oranges and tangerines are used for juice. Lime juice from West Indian limes has a peculiar, harsh taste, and is used mostly for ship-board use as a remedy for scurvy.

FRUIT WINES

Fermented fruit juices are greatly similar to wines, which are also fermented grape juices. Unfermented fruit juices, sterilized, must not be called "non-alcoholic wine" or "fruit wine," for it is a characteristic of wines and beverages similar to wine that they are the product of fermentation. Also fruit juices, even those from grapes included, which have been fermented and their alcohol then distilled off, must not be labeled "non-alcoholic wine" but must bear a declaration stating the character of their manufacture.

The fruit wines are classed among the alcohol beverages, and only their originating from the juice of fruits permits them to be described here briefly. The fruit juices all contain too little sugar naturally to yield a sufficient content of alcohol, and otherwise they are too acid. The manufacture of fruit wines is similar to that of wines. The fresh grapes are pressed, and the must is fermented. Much care is to be taken in the treatment during the fermentation, and in completing of the wines and their storage. The composition of grape juice adapts the latter to afford good beverages after fermentation, but regarding fruit juices in general, these must be prepared otherwise, as they contain in most cases too much acid and too little sugar. The requisites for a good fruit wine are, that it contain about $6\frac{1}{2}$ pro mille acid, and an average of $8\frac{1}{2}\%$ by volume of alcohol. Therefore the must must be brought up to a content of $14\frac{1}{2}$ to 15% of sugar, and the acid must be reduced by adding water to about $6\frac{1}{2}$ pro mille.

For wines with a higher content of alcohol, as dessert wines, the content of sugar is correspondingly increased so as to yield a higher content of alcohol. To render uniform the fruit wines, so far as their content of alcohol and acid is concerned, the addition of sugar and water is necessary, as given in the formulas later on.

The fruits are employed when fully ripe, and are pressed and fermented after the addition of sugar and water. Only rarely are the fruits themselves fermented, but usually only the juice. It is advisable to employ pure cultivated yeast, which corrects the taste in certain directions, hastens the fermentation, and is a

remedy for certain wine maladies. The most suitable pure yeasts are "Steinberger Cabinet" for light-colored fruit wines; for dessert wines "Laureiro;" and for dark red wines "Bordeaux." In some cases the wines are very poor in tannic acid, which supports the fermentation, and it is usual to increase the tannic acid by the addition of about $\frac{1}{4}$ oz. per gallon.

The fermentation of the juice is at first turbulent, but becomes calmer by and by, and after some months the must is turned, and filled into new casks, where an after-fermentation takes place, and about a year after the fruits were harvested, the wine is complete.

The wine gains in clearness and bouquet when stored for some time. In some cases, particularly where the juices are very low in acidity, the nutritive materials present are not sufficient for the yeast. In such cases it is advisable to add $\frac{1}{4}$ to $\frac{1}{2}$ oz. of ammonium carbonate to each gallon of must, sufficient to induce fermentation.

The table on page 156 shows how much water is required to reduce the acidity of 10 gallons of original fruit juice to an average acidity, and also the quantity of sugar which is added to this dilution for certain results, varying according to the alcoholic strength. The ordinary fruit wines, also called household beverages, have an alcoholic strength of 50° underproof; light table wines, 48° underproof; stronger table wines, completely fermented, 45° underproof; and so-called dessert wines, 41° underproof, which is the limit of possibility of natural content of alcohol from fermentation. The quality of these depends upon the addition of sugar.

When fruit wines are distilled to regain their alcohol the residue will be alcohol-free. This product must be declared as "non-alcoholic fruit wine, freed from alcohol." This manufacture is not limited only to the distilling off of the alcohol, which affords a distillate of about one-third of the total amount of wine, but this distillate must be replaced by sugar solution, because without alcohol the taste of the wines would be flat, and not full enough. Therefore they must receive an addition of sugar, best fruit sugar or true grape sugar obtained by evaporation from grape juice. They must be sterilized, of course, and are in no sense better than genuine fruit juices, which should be preferred because of their more natural taste.

Composition of Fruit Wines

10 gallons of natural fruit juice of average content of sugar and fruit acid afford:

Berry wines.	Addition of water for reducing the acid.	Addition of sugar for various strengths:			
		Household beverages, 50°.	Table wine.		Dessert or liquor-wines, 41°.
			Light, 48°.	Heavy, 45°.	
	Gal.	Lb.	Lb.	Lb.	Lb.
Bilberry	24	42	56	76	110
Blackberry		10	14	20	30
Cranberry	35	62	80	106	151
Currants, black	20	40	65	90	
" red, or white	30	50	70	90	130
Gooseberry	30	32	43	60	88
Mulberry	18	32	43	60	88
Raspberry	18	32	43	60	88
Strawberry	8	20	26	37	55
Other fruit wines.					
Agriots	5	12	20	30	40
Apple		5	10		
Apricot		8	16	25	35
Cherry, sweet		5	10	15	20
Peach		8	16	25	35
Plum	5	15	25	35	50
Lemon wine	100		150	(Use yeast nutrient.)	
				¼ oz. for 10 gallons.	
Orange, sweet	40		80	Ammonium Carbonate	

Rhubarb wine is manufactured from the juice of green rhubarb stems, which are boiled with an equal part of water; for every gallon add $2\frac{1}{2}$ lb. sugar, and then ferment like fruit wines.

In making *apple wine* it is usual to employ besides sour apples also sweet pears, which contain also tannic acid. Sorbberries also are added to apple wines to make them more astringent.

Fruit champagnes are nothing else but genuine fruit wines with a considerable content of alcohol, but sweeter and impregnated with carbonic acid.

Honey-wine, called *mead,* is obtained by the fermentation of genuine honey with the addition of suitable spices as coriander. cardamom, nutmeg, cloves, etc., and more rarely with hops when a bitter and aromatic taste is desired. To make it, 32 lb. of honey, boiled with 10 gallons water, are fermented after cooling and adding pure yeast. Any added spices are boiled with the honey as before, and the loss of water is replaced. The meth will

be completely fermented after a few months, and after clearing is filled into bottles for the trade.

Fruit-honey wines (*fruit-meads*) obtained by fermentation of genuine fruit juices with honey are to be recommended. To obtain the desired astringent taste in some kinds, tannic acid is added. Sometimes it is advisable to add raisins to the mash; and also, if not acid enough, some tartaric acid may be added. The manufacture is as follows: The honey is boiled with the water, and then the tannic and tartaric acid are added. If any raisins or carobs are to be used, these are boiled at the same time. Replace any loss of water by boiling, and after cooling add the fruit juice and pure yeast, allow to ferment for a few months, clear, then bottle. The following table shows the composition of these wines:

HONEY-FRUIT WINES (FRUIT-MEADS)

	Honey.	Water.	Tartaric acid.	Tannin.	Fruit-juice.	Raisins.	Carobs.
	Lb.	Gal.	Oz.	Oz.	Gal.	Lb.	Oz.
Apple	8	...	2	.....	9½	3	2
Apricot	5	2	1	¼	2½	......	..
Bilberry	5	2½	1	¼	2	......	2
Blackberry	7	2½	1	....	1¾	......	..
Cranberry	6	2½	1	½	2	......	...
Currants	5	3	1	......	1½	3	....
Gooseberry	6	2½	1¼	..	3	....	....
Peach	6	1½	1	¼	3	....	....
Plum	6	1½	1	¼	....	....	....
Raspberry	6	1	1	....	3½	....	......
Strawberry	5	1½	1	....	3	......	....

JUICES FROM DRIED FRUITS

With the drying of fruits the water, which serves for keeping in solution the soluble substances of the fruits, partially disappears, and carries with it considerable of the flavor, while on the other hand the flavor is altered by the heat. When dried fruits are macerated again with water, the soluble substances enter into solution, but the taste differs from that of fresh fruits. The new product is not at all the same as a fresh-fruit juice, and cannot of course bear the designation "fruit juice." If any beverages are manufactured from dried fruits, as "Pomril," the beverages may bear any fancy name, but no intimation that they are manufactured from fresh fruits.

THE MANUFACTURE OF JAMS (MARMALADES) AND JELLIES

The manufacture of fruit preserves, such as jams and jellies, is often united with the manufacture of fruit juices, as the residues from the latter may be utilized.

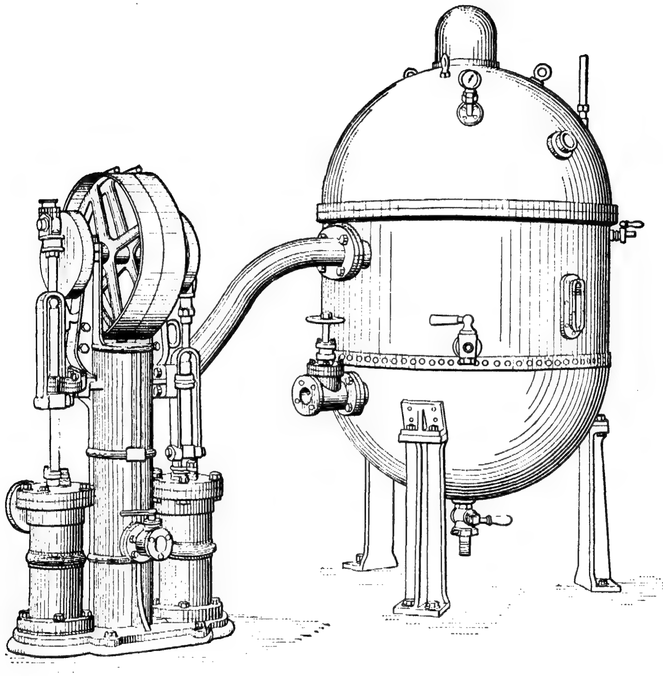


FIG. 28. Modern vacuum apparatus for jam manufacture, with air pump.

The basis of jams is fresh or dried fruit, and for jellies true fruit juices. Both are products with a considerable content of sugar, or dextrose as a substitute to make the products cheaper for the poorer trade. As a rule, it is to be understood that 45% of the total weight shall consist of fruits, with the exception only of very sour fruits like lemons and oranges.

Because of the high content of pectase, apples are best suited for the desirable consistency of jams, and therefore apple pulp is most used for mixed jams. Apple pulp must be declared if any is added to a jam labeled with a fruit name. Only 25% of the total fruits may be substituted by apple pulp. When more

is used, the only designation allowed is "mixed fruits." If dried fruits are employed, only 25% of the pulp is allowed as a substitute for the total fruits. Husks of every kind, and by-products, must not be employed in jams designated by the names of fruits, but are allowed in mixed jams up to the amount of 25% of total fruits, but with a declaration only. If more than 25% are employed the jams must be labeled "artificial." Instead of sugar, dextrose or glucose syrup is often added. The content is to be declared. According to the German law 25% of glucose is to be declared as "with glucose." More than 25% must be declared as "more than 25% glucose." Any addition of gelatinous matters, as agar-agar, and colors also, must be stated. The washed fruits are boiled with some water and passed through a sieve by which the stems, kernels and stones are removed. The pulp is then mixed with sugar or glucose, and boiled in a vacuum to the desired consistency. It is forbidden to add any flavor to jams which bear the names of fruits unless they are declared as "artificial." Only jams from lemons or oranges may receive an addition of flavor of fresh peel essences.

The jellies are manufactured from fresh fruits, which, if necessary, are cut small and boiled with water. When soft enough, place them on a sieve and allow the juice to drain off; then filter if necessary, add sugar to the extent of half of the weight of the juice and boil to the right consistency. The test for proper jelly consistency is when it does not disintegrate in cold water. If boiled beyond this test the mass "burns" and loses its ability to gelatinize. Glucose is allowed if declared, and so also coloring matters and gelatinizing substances. When designated by the name of any fruit, only 25% of the total fruit may be substituted by another fruit without declaration.

The favorite pulps are apple pulp, pear pulp, or mixed fruit pulp, when apple and pears are employed together, even though apple pulp may contain, as allowed, 20% of pear pulp. Sugar beets are also adapted for affording a pulp for cheap grades, but no addition of any glucose is allowed. Every jelly containing glucose or beet pulp must be declared as "mixed," and when containing still other substances, as "artificial."

Regarding jellies and jams it is forbidden to employ fruits or parts of fruits which are leached out or distilled, or the residues of these processes.

For artificial jams fruit flavors are used, but artificial flavors, like fruit ethers, should be avoided. The pulps for jams can be stored in sterilized form, and boiled for jams when wanted.

The following table shows the constituents of some jams made from fruit pulps. According to the English taste the fruits are sieved less thoroughly. For some jams, as, for instance, orange, the peels are also partly used, being cut in strips, boiled till soft and mixed into the complete jam.

Composition of Some Jams

The constituents are to be boiled together to the usual consistency. (Apple pulp is used because of its ability to gelatinize more promptly.)

Apple Jam: 2 parts apple pulp and 1 part sugar.

Bilberry, Cranberry and Plum Jam: 3 parts plum pulp and 2 parts sugar.

Cherry, Currant, Hip, Peach and Strawberry Jams: 2 parts of the fruit pulp, 1 part apple pulp and 3 parts sugar.

Apricot Jam: 3 parts apricot pulp, 1 part apple pulp and 4 parts sugar.

Agriot Jam: 2 parts agriot pulp, 1 part currant pulp, 1 part apple pulp and 4 parts sugar.

Raspberry Jam: 2 parts raspberry pulp, 1 part currant pulp, 1 part apple pulp and 4 parts sugar.

III. ESSENCES FOR LEMONADES AND NON-ALCOHOLIC BEVERAGES

The Nature of the Fruit Flavor, and Its Transfer to Essences

The fruit flavor is a constituent of the ripe fruit, in which it is formed by the action of sunlight. It is hence more particularly elaborated in colored fruits, and in the more highly colored portions of fruits, in consequence of which the more richly colored fruit is usually the more fragrant. Only in the citrus fruits is the flavor so highly developed that it forms a volatile oil which may be obtained by expression. Otherwise, the flavoring substance is present in only very small quantities, it occurring in the rind of the fruit, while only a slight quantity is found in the fruit juice, because the water of the fruit juice is but a poor solvent for it. At any rate, it is only the most volatile portions of the flavoring agents that impart aroma to the fruit juice, but the major part remains in the fruit pulp or residues, and hence these latter

constitute the chief sources for the manufacture of essences. The fruit flavor is, moreover, rather sensitive to heat, and particularly in the presence of albuminous matter, which is present in every fruit, it develops, when heated above 170° F., the so-called "boiled" or "baked" fruit taste, to avoid which distillation in vacuo is practiced.

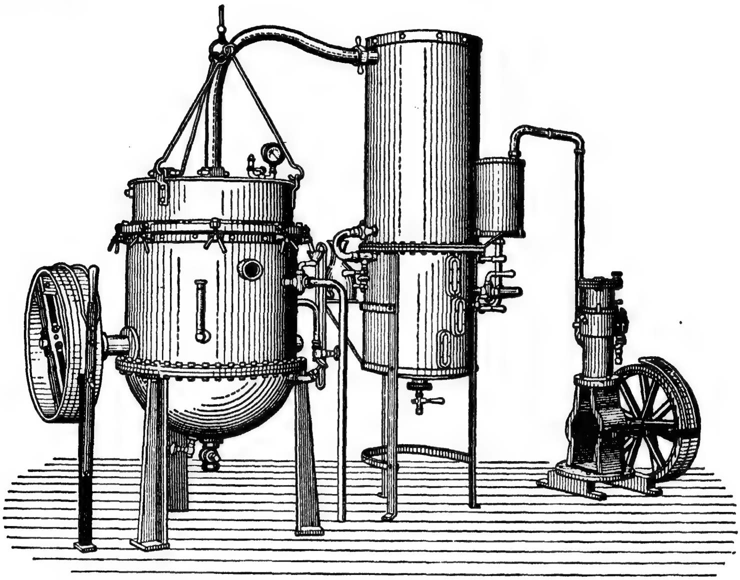


FIG. 29. Modern vacuum apparatus for essence manufacture.

It is impossible to isolate the fruit flavor as such, as is done with volatile oils, excepting in the case of the citrus fruits, but it may be transferred by distillation with alcohol; and the less heat required for this, the finer and more natural will be the flavor solution obtained. Once in solution it is easily carried over by the alcohol vapors, and imparts to the condensate its volatile, fruity taste, and of course extractive flavoring substances are precipitated. In those cases where no vacuum apparatus is at hand, such methods must be resorted to in the case of particularly delicate flavors, such as strawberries, bananas, pineapple, peaches and apricots, as will bring the total flavor, including that of the extractive substances, into solution by means of maceration, whereby, unfortunately however, the concentration of the resulting essence is very greatly reduced.

It is the aim, in essence making, that, although the use of alcohol for utilizing the flavor cannot be dispensed with, yet the quantity should be limited to a minimum, not only because alcohol as such is not desired in beverages, but also because it is costly. Hence it is the object of the manufacturer to make the essences as concentrated as possible. In other words, it is the object to transfer the flavor from the greatest possible quantity of fruit to the smallest feasible quantity of alcohol, and this is possible by distillation only, in that the distillate from one batch of fruit may be used for the treatment of another batch; and in fact this process may be repeated as often as desired, a process which is entirely excluded when maceration is resorted to because the alcohol strength would be too greatly reduced by the moisture present in the fruit.

Finally it may be mentioned that the fruit flavor may also be isolated, after it has first been brought into solution, whether as extract or distillate, or even as fruit juice, by shaking out the solution with a solvent in which the liquid first used is insoluble, for instance petroleum ether, chloroform, etc. If now, using proper precautions, the new solvent used for shaking out is distilled off, there remains in an exceedingly concentrated form the flavoring, which is more usually than properly designated as "aroma oil," or "flavor oil."

The purpose of all these methods of transferring the flavor to a solvent, from which all fruit essences are made, is to later impart the fruit taste to beverages, and the advantage of this as compared with the natural fruit juice manufacture is the avoidance of the inconveniences attending the latter. Fruit juices all contain fermentible constituents, and in the dilutions as used in lemonades are not stable unless they have been sterilized by processes that are inconvenient to employ. Then again it is maintained that the carbon dioxide exerts a destructive action on the coloring matters, but the most important fact is that the pleasant taste of lemonades depends upon a correct relationship between the quantities of acid and sugar. Now the sugar content is practically constant, because the sweetness of a lemonade is always brought to a certain point by the addition of sugar, so that the lemonade will contain about 6 to 8% sugar. The acid content of the fruit juices, however, varies greatly; the different kinds differ not only from each other, but members of the same kind differ among

themselves. For commercial purposes, however, it is desirable that the manufacturer should market products of uniform quality, and this is effected by the manufacture of artificial effervescent lemonades.

Effervescent lemonades are not intended to be duplicates of the natural lemonades, but are individual commercial products of greater uniformity than the natural lemonades, not only with reference to the acid content, but also as regards flavor. They are to a certain extent the derivative products of the fruit-juice lemonades. The most important factor of the fruit juice is the fruit acid, and this, in the effervescent lemonades, is employed in unobjectionable form, since citric and tartaric acids are natural products obtained from fruit juices only by a chemical process. The fruit flavor, in the form present in the fruit, is also obtained from fruit by unobjectionable methods, and the only purely artificial things are the coloring and the foam producer, and these constituents enter into the composition of every effervescent lemonade, because the sugar which must be used is present in the proportions in which it must be added to natural lemonades.

ARTIFICIAL FRUIT FLAVORS, FORTIFYING AND FIXING

The fruit flavor is a very sensitive substance, and in the high dilutions in which it occurs in lemonades it is not easily to be tasted, because of its volatility, and because the impression it makes on the tongue rapidly disappears. In order to render the taste more permanent, the natural fruit flavor is fortified many fold with so-called "fixers." The most important reason for their use is based upon the fact that, because of their lower volatility, less volatile substances, such as high-boiling esters, artificial odorants like vanillin and cumarin, or volatile oils, when used in conjunction with the fruit flavor, keep the fruit flavor longer in contact with the taste-cells of the tongue. The purpose of these fixers is in nowise to increase the fruit flavor or even to imitate it, but to utilize it more advantageously. All fortifiers are artificial in character; they consist of esters, volatile oils and artificial odorants, and they are used to secure a certain degree of uniformity in the taste of the fruit, to exclude any by-taste, and to round out the taste and impart to it a certain type. Their use is fully justified so long as their employment is not carried to

excess and the basic character of the flavor is not impaired or imitated.

The *artificial fruit flavors* are used only for the purpose of imitating the flavor and excluding the natural content. They are capable of imparting only a similarity of flavor, and consist chiefly of the so-called fruit ethers, the employment of which, however, meets with but little public approval; and the saving effected by using such imitations is not at all worth while, apart from the fact that the ethers are not considered to be entirely unobjectionable in their effect on the health. In the course of time the public has come to look with disfavor on the artificial fruit flavors formerly employed, and in the formulas which follow no attention will be paid to such imitations.

COMPOSITION OF EFFERVESCENT LEMONADES

Sugar is the basis of all lemonade-like beverages, and it is employed in the form of a 60% syrup; in fact it was customary, after adding to the syrup flavoring, acid and coloring, to designate it as so-called lemonade syrup, of which 1½ oz. was used for a 12-oz. bottle.

So far as the acid is concerned, the cheapest to use is *tartaric acid*, which is obtained from the tartar separating during the alcoholic fermentation of grapes. Of equal value is *citric acid*, obtained from the natural juice of lemons. Both of these are equivalent so far as their acid value is concerned. Less frequently employed is *lactic acid;* and of the inorganic acids only *phosphoric acid* is to be considered, although beverages made with this are stated to have poor keeping properties. The acid content of the various effervescent lemonades varies but little, and amounts on the average to 1% of the lemonade syrup. About 1 lb. of citric or tartaric acid is employed with 100 lb. lemonade syrup; the equivalent quantity of lactic acid is 1½ lb., and of phosphoric acid (75%) 1 lb. With the more strongly acid fruits, such as lemons and apples, half again as much acid is employed, as this better represents the character of the fruits.

The *coloring* of the effervescent lemonades follows in most cases the colors of the respective fruits, the flavors of which are to be used, and is intended to be attractive to the eye. So far as the aniline dyes are permissible to be used, they are the most satisfactory and brilliant, as the vegetable colors are very unstable.

The last constituent to be mentioned, apart from the essences, is the *foam producer*. This consists of any form of solution of saponin, found as a glucoside in various plants. This is considered by many as not free from objection from the hygienic standpoint, and in many countries its use is forbidden. Other glucosides, such as glycyrrhizin from licorice root, are not satisfactory, although otherwise unobjectionable, as foam producers. The purpose of the foam producer consists in that, although used in high dilution, it causes a considerable foaming of the beverage or lemonade, and affords a dense "head" persisting for some time, and preventing the too rapid escape of carbon dioxide. Furthermore, its effect on the eye has a certain esthetic value which is utilized, for instance, in foaming beers.

STANDARD ESSENCES AND EXTRACTS

It is the aim in manufacturing to simplify the employment of the various essences so that the flavoring value of all is brought to a certain normality. As *standard* we designate a quality of which 1 part by weight suffices to flavor 100 parts by weight of lemonade syrup. This of course does not hinder the marketing, for purposes of convenience, of strong or weaker concentrations; and by the term the *extent of utilizability* is understood the number of parts by weight required to flavor a lemonade syrup, such parts being most conveniently stated in terms of the number of ounces required for 1 gallon. Hence the normal proportion 1 : 100 signifies that 2 oz. per gallon are required to flavor 1 gallon of syrup containing about 57% sugar. Thereby it is assumed that a syrup containing 60% sugar is used as a base, of which 95 parts by weight are mixed with 5 parts of the so-called lemonade extract, which contains besides the essence, acid, coloring, and perhaps also foam producer.

This lemonade extract is for the purpose of uniformity, calculated for a yield of 5 : 100, corresponding to the employment of 10 oz. of the finished lemonade syrup, *i.e.*, 10 oz. of the extract are mixed with sufficient sugar syrup to measure 1 gallon. The acid is used in solution, this being made from equal parts of citric (or tartaric) acid and boiling water. When cold, the solution is filtered. The usual proportion for most beverages requires an acid content of 1 : 100, calculated on the weight of the syrup, and for acid products, as lemon and apple, 1½ : 100; hence for a gallon

of lemonade syrup there are required 2 to 3 oz., or 4 to 6 oz., respectively, of the acid solution. The lemonade extract contains at the same time the dissolved coloring matter, and it is most advantageous to use a solution of 5 parts of the dry aniline dye in 100 parts water, *i.e.*, a 5% solution. Vegetable colors, having less coloring power, are prepared in more concentrated solution. Such coloring solution is used in the proportion of ½ part to 100 parts of syrup. Hence 1 oz. of the solution will be required to color 1 gallon of syrup. If a foam producer is also employed, a foam extract is used which is also made 1 : 100, and of which 1 oz. is required for 1 gallon of syrup. From the foregoing, hence, the extract will have the following composition:

Normal Essence, 1 : 100	2 lb.
Acid Solution, 1 : 1	4 "
(or 6 lb. for strongly acid beverages)	
Coloring Solution, 5%, as aniline dye	1 "
(or more if a vegetable color is used)	
Foam Producer	1 "

This affords 8 lb. of an extract of not too acid character, and which is made up to 10 lb. by adding 2 lb. distilled water, corresponding to a utilizability of 5 : 100. With strongly acid beverages, however, 2 lb. more acid solution have to be added, hence here the resulting yield, without the addition of the water, is again 10 lb. The range of 2 lb. also allows the possibility of adding more acid at will, or, if desired, of increasing the quantity of essence to be added in cases where weaker essences are used. In colorless lemonades and in such where no foam producer is used, the corresponding additions are naturally omitted, and the shortage is then made up with distilled water instead, so that in every case the extract will have a uniform utilizability of 5 : 100, requiring the addition of 10 oz. to the gallon of syrup.

The syrup usually requires 7 times its volume of water for lemonades, corresponding to the use of 1½ oz. for a 12-oz. bottle. The quantity of syrup is usually measured by mechanical means into the bottle, and then the latter is filled with carbonated water; the lemonade is then ready for consumption.

TURBIDITY OF EFFERVESCENT LEMONADES

Assuming that all the ingredients — the essence, acid and coloring solutions, and the foam producer — are perfectly clear, and

also that the water used is perfectly pure, no turbidity is possible; and if it occurs, it must be ascribed to some carelessness in the manufacture. When, in spite of all precautions, a turbidity is now and then observed, this can be ascribed to the essence only when the latter has been carelessly made. An important cause of turbidity is due to mold development, and this is due to the water employed not having been sterile, hence the greatest care must be directed to the quality of the water; and for all cases distilled water is to be preferred. Another frequent cause of turbidity is due to the rinsing water; by allowing emptied lemonade bottles to stand around infection very easily occurs, and the bacteria are distributed through the rinsing water, and where the latter is not sufficiently renewed, the bacteria reach the bottles and later on develop in the lemonade. Only in rare instances is there found a peculiar mold formation in which, with continued development, the cells take up the dye, and carry the latter to the bottom of the bottle as a colored precipitate. Still more rare is the occurrence of the so-called mucous mold, which causes the contents of the bottle to become gelatinous in character. All these untoward occurrences are, however, due solely to insufficient and careless rinsing. They are never due to the essences or extracts, as the alcohol content of the essences is so high that bacteria cannot live in them, while the acid content of the extracts is too great to allow the development of bacteria in them.

FOAM PRODUCERS

The object and purpose of these have already been discussed. There only remains to give the methods of making them. The foam producers are all made from saponin, obtained from soap bark, soap root and soap nuts. There are a number of kinds of saponins, of which some, *e.g.*, the so-called sapotoxin, are toxic. Nevertheless it may be stated that in the very small quantities in which saponin is used there can be no real danger to health. On the average foam extracts all contain 10% saponin, hence a gallon of lemonade syrup (= 8 gallons of finished lemonade) contains only $\frac{1}{10}$ oz. saponin, = 0.008%.

The saponin is obtained by exhausting the above-mentioned raw materials with water. The albuminoids in the solution are then precipitated by means of formaldehyde, and the clear solution is evaporated to dryness in a vacuum. The resulting product is a

very hygroscopic powder which is strongly sternutatory, and which must be kept in well-stoppered bottles, as otherwise it conglutinates to form difficultly soluble lumps. The *simplest foam extract* consists of a solution of 1 part saponin in 9 parts hot water, which is filtered if necessary, and rendered stable by the addition of 1% sodium benzoate. Of this solution 1 oz. suffices for a gallon of lemonade syrup.

Foam Extract from Soap Root

The white Levantine soap root is comminuted, and percolated with cold water. The constituents of the soap root are very prone to undergo fermentation, which renders it difficult to clarify the liquid extract. This inconvenience is avoided by adding 1% of 25% formic acid to the water to be used for percolating. The percolation is best carried out in a percolation vat, 40 gallons of water acidulated with the formic acid being poured over 50 lb. of the root. After allowing to stand for 3 days, 20 gallons of percolate are collected; a further 20 gallons of formic acid water are then poured over the material, and another 20 gallons of percolate collected in a separate vessel. These 20 gallons are employed for a new percolation, the liquid being poured over 50 lb. of soap root, followed by 20 gallons of water, the whole allowed to stand for 3 days, and 20 gallons of finished foam extract again collected, after which the process is repeated as before. The percolate is then heated to boiling in an open kettle whereby the albuminoids are for the most part coagulated. The contents are then allowed to cool in a stone jar, and filtered. If necessary, the completed extract may be preserved by adding 10 volumes of alcohol, unless it is preferred to add 1% sodium benzoate.

A *purified form* of this foam extract is obtained on evaporating the above obtained product to one-tenth its volume, whereby an almost viscid extract is obtained, which is then mixed with three times its volume of strong alcohol. This precipitates the useless extractive matters, plant salts, albumin and pectin. A volume of water equal to that of the alcohol used is then added to the filtrate from the alcoholic liquid, and the alcohol is recovered by distillation; this alcohol, when rectified, may be used over again for the like purpose. The residual liquid is then made up to the original volume by adding distilled water, and preserved. Such extracts are also used in the proportion of 1 oz. to 1 gallon of syrup.

In similar manner, a foam extract may be made from *soap bark.* The recently recommended *soap nuts* are considerably richer in saponin, and an extract may be made from them in the same way as from soap root, using, however, only 25 lb. of soap nuts instead of 50 lb., in order to make 20 gallons of foam extract. Soap nuts have not come into common use because they contain a bitter substance which it is difficult to remove, and which impairs the taste of the lemonades.

The advantage of using an alcohol-purified foam extract resides in the fact that the foam it produces has smaller bubbles, and hence persists longer on the liquid.

Saponinless Foam Extract from Licorice Root

For making this, *licorice root* is used; it is percolated just like soap root, and the percolate is treated exactly like the alcohol-purified extract above described. The utilizability of this extract is low, and hence twice as much is required, *i.e.*, 2 oz. per gallon. Better results would be obtained with a larger quantity, but the licorice taste would be too much in evidence. In addition it may also be mentioned that the glycyrrhizin, to which the foam production is due, is incompatible with acids, hence pure glycyrrhizin can scarcely be used, because it is marketed only as the ammonium salt, and this is decomposed by acids with the precipitation of the glycyrrhizin.

GENERAL METHODS OF MANUFACTURING FRUIT ESSENCES

1. Vacuum Distillation

The advantage of vacuum distillation resides in the fact that the fineness of the flavor is impaired by the heat, which, using the open distillation with alcohol, lies not far from the boiling-point of water. When operating with reduced pressure, the greater part of the operation, namely the extraction and distillation of the major portion, is carried on at a temperature between 95 and 100° F., and only with a decrease in the alcoholic content does the temperature rise to a maximum of 135° F. The "boiled" taste, which is partly due to the albumin content of the fruit, and also the "kettle" taste, which usually sets in first at 170° F., are thus entirely avoided. A further advantage lies in the more complete utilization of the material, because the various operations

are carried out in the kettle from which the outer air is excluded whereby loss of alcohol by evaporation, as also of flavoring, are largely avoided.

The work comprises an extraction, the object of which is the solution of the flavoring constituents in the plant cells, and a distillation, whereby the dissolved flavoring is carried over in the distillate. Alcohol serves as a medium in all cases; and it is the purpose to exhaust the largest possible quantity of fruit with the smallest feasible quantity of alcohol. The most suitable apparatus for the manufacture of fruit essences is provided with a condenser. It consists of a lower portion, higher than wide, provided with the usual means of steam heating; the upper part is closed by a cover provided with a condenser, which, for convenience of emptying and charging, can be raised. For rinds and voluminous material, a sieve is fixed one-third the distance from the bottom of the kettle. For soft fruit, as raspberries, as well as for fruit residues, the sieve is not required. By means of a window, the processes within the apparatus may be watched, while a thermometer and barometer show the existing temperature and pressure. The work is carried on at a pressure of about 680 to 700 mm., obtained by means of an air pump. The cover-condenser is so arranged that a current of cold water constantly flows through it and condenses the vapors so that the condensate falls back upon the material and does not escape into the main condenser, the extraction being based upon this principle. The kettle is connected with a capacious main condenser, the exit tube of which is closed by a three-way cock. One exit leads directly into the open, so that the apparatus may also be operated as an ordinary still, for which purpose it is used in the manufacture of fruit-rind flavors for removing the terpenes in the last stage of the work. In this event the contents of the condensed distillate empty into a Florence flask, in which the terpenes collect, while the balance of the contents flows back into the apparatus through a siphon, which, of course, cannot take place in a vacuum. The three-way cock is also connected with a double receiver. The latter is divided into two unequal chambers by a false bottom, each chamber being provided with a graduated glass window in order to observe the contents at all times. Both chambers are connected by a cock, so that the distillate in the upper chamber may be allowed to run into the lower, hence the latter may, to a

certain extent, be regarded as a reservoir. Each chamber is individually connected with the air pump, and may be shut off by itself; in addition, each chamber is provided with an air cock, and

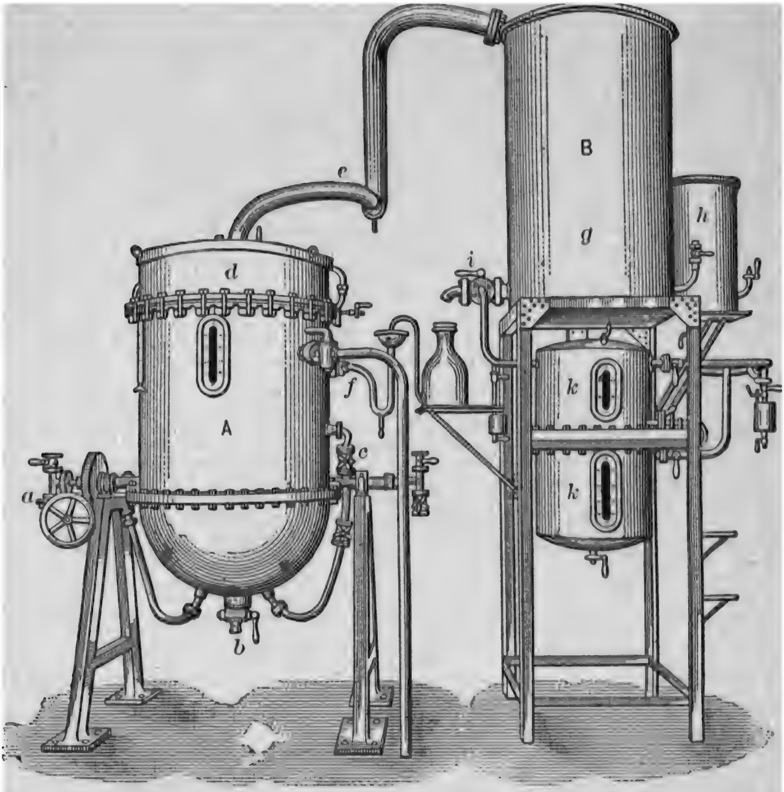


FIG. 30. Vacuum still for fruit.

A. THE COMPLETE STILL.
- (a) Stirring mechanism.
- (b) Cock for emptying.
- (c) Direct and indirect steam regulation.
- (d) Condenser cover.
- (e) Tube for carrying vapors.
- (f) Distillate return.

B. THE CONDENSER.
- (g) Main condenser.
- (h) Supplementary condenser.
- (i) Return tube with Florence flask.
- (k) Double receiver connected with the pump.

the lower one has also a cock for emptying. When a proper quantity of distillate has collected in the lower chamber, it may be shut off from the upper, and emptied, while the distillate continues to collect in the upper chamber. The distillation may

hence be interrupted at will and the contents drawn off; and afterward, after again effecting a vacuum, connected up, thus rendering possible a continuous operation. The charging of the apparatus with fruit is effected by lifting the cover, and the emptying of the mushy contents is accomplished by means of a large cock; voluminous material is taken out through the charging opening. If desired, the apparatus may be made to tilt, and it may be provided with a stirrer. In the following operations the kettle should have a capacity of about 60 gallons. The speed of the distillation in such case should be about 10 gallons per hour. The regular charge of fruit material should be about 300 lb. in the case of mashed fruit; of lemon or orange peel, which are to be placed on the sieve, only 200 lb. should constitute a charge, and these are the quantities which are to be used in the general operations to be described. A further general rule is that for every such charge 25 gallons of proof spirit are to be used.

The Extraction

After the apparatus has been charged with the fruit, a vacuum is effected, and 25 gallons of proof spirit are drawn in. Heat is now applied to incipient boiling, while plenty of water is allowed to flow through the cover condenser. This requires a temperature of from 90 to 100° F. The vapors arising are condensed on the upper surface, and the liquid drops back on the material. By means of this continuous cycle, the flavor is always acted upon by the same quantity of alcohol, and brought into solution, whereby as little as possible of the distillate should be allowed to reach the main condenser. For this operation about one hour is required. Then the cover condenser is shut off from operation, so that the distillate may reach unhindered the main condenser and collect in the receivers. In cases where the vapors, through some accident, or careless overheating, have not been absolutely condensed, loss may be guarded against by interposing a supplementary condenser between the receiver and the air pump, whereby all vapors are condensed before they can reach the air pump.

The Distillation

This is effected without using the cover condenser, and can proceed smoothly so long as the cooling is thorough. On the average 10 gallons of distillate are obtained per hour. The object

of the distillation is to completely regain the alcohol, and with it all the flavoring that passes over. As, however, the distillate is to serve also for the next batch of fruit, only as much distillate must be reserved as the quantity of liquid originally used, namely, 25 gallons. Of course it is understood that, in order to have enough liquid in the kettle, the liquid distilled off must be replaced by water, which is drawn in during the operation in such a manner that every hour, after 10 gallons distillate have been collected, 10 gallons of water are introduced. The distillation is checked after 25 gallons of distillate have been collected in this manner. In like manner a further 10 gallons is distilled off after the appropriate quantity of water has been added, this distillate being intended to carry over any residual alcohol or flavoring; the distillation is then at an end.

Concentration

It is now required to strengthen the flavor so obtained, and for this purpose the distillate from the first operation is used as the starting material for the extraction of a new batch of fruit. The apparatus, previously emptied, is hence charged with another like quantity of fruit or rinds, and the 25 gallons of main distillate are added. The extraction is now proceeded with as before, including the distillation. 25 gallons of main distillate are again obtained, which must be twice as strong as the first. As, of course, more liquid must be introduced into the apparatus, the 10 gallons secondarily obtained from the first extraction are added first, and then the water necessary. The product of the second distillation is again 25 gallons of main distillate and 10 gallons of secondary distillate; and this method of manipulation may be repeated as often as desired.

As a rule, using rind fruits, such as lemons, oranges and mandarins, the operation is repeated four times, so that using four times 200 lb. of rinds with only 25 gallons of proof spirit, there are obtained at the end of the fourth operation 25 gallons of distillate enriched fourfold, and the usual 10 gallons of secondary distillate which, as it contains a large quantity of terpenes, as we will see later on, is treated in a special manner.

With the other kinds of fruits the operation is usually repeated a sixth time, the first to the fourth being carried out as already described; the fifth is varied in that only 15 gallons are collected

as the main distillate, while 20 gallons are collected as the secondary distillate. The sixth manipulation has another purpose; its object is the enrichment of the very concentrated distillate with natural extractives which impart to the essence a full, rounded flavor, and which, by reason of their tannin content, favor the ripening of the essences on storage. At the same time they impart to the essence the requisite natural coloring. For this purpose, the procedure is as follows: The usual 300 lb. of fruit are again used, but this time the fruit is first expressed as thoroughly as possible, so that only about 100 lb. of residue remain, with about 2½ gallons of juice which for the present is reserved. The residue is now packed in an upright percolator cask after being moistened with the 15 gallons of distillate from the fifth operation. The percolator is open at the top, and is provided with a glass cock; the maceration is allowed to proceed for a day. Thereupon the cock is opened, and the extract allowed to run off without any pressure being applied, about 12 gallons of extract being thus obtained and set aside. The total material in the percolator is now mixed in the kettle with the juice reserved and the 20 gallons of secondary distillate from the fifth operation, and the distillation is proceeded with, neglecting this time the superfluous extraction, until about 20 gallons of distillate are obtained. Thereupon the apparatus is emptied, and the distillate is rectified once more, so that 15 gallons are obtained, which are then mixed with the extract obtained as above. This finished essence is now placed on the balance, and distilled water is added to make it weigh 300 lb., thus bringing the essence to a utilizability of ½ : 100, = 1 oz. per gallon syrup. Altogether we have used six times 300 lb. of fruit and only once 25 gallons of proof spirit, hence the resulting 300 lb. have an alcohol strength of about 20° underproof.

Removing the Terpenes from Rind Essences

As we have seen, after the fourth operation there have been obtained 25 gallons of main distillate. The latter, together with 20 gallons of water, are now placed in the still and distilled over, but without using a vacuum, into the Florence flask. The terpenes are carried over with the strongly alcoholic vapors, but separate immediately on condensation, collecting as a light, oily liquid in the Florence flask while the alcoholic portion flows back into the still. This reflux distillation is carried on until

the oily layer in the receiver no longer increases in volume. The receiver is then disconnected, and the alcoholic liquid is poured back into the still; the terpenes are dried over anhydrous sodium sulphate, and utilized as a side product which may be used for cheap soaps and for diluting ethereal oils. A further 10 gallons of water are now added to the contents of the still, and 40 gallons are distilled off, which are filtered to remove any residual terpenes or other turbidities, using infusorial earth (Kieselguhr) to obtain an absolutely brilliant filtrate which is once more distilled to yield 30 gallons. This distillate is now placed on the balance, and distilled water is added to make it weigh 300 lb., the finished essence also having a utilizability of $\frac{1}{2}$: 100 = 1 oz. per gallon of syrup.

Diluting the Essences

The methods described above yield perfectly pure fruit essences which, when made from rinds, require no preservatives, such as may have to be added to essences prepared from other kinds of fruit. The concentration is quite considerable, and the alcohol content in every case is 20° underproof. From this it follows that to dilute the essence to a standard quality of 1 : 100, only an equal volume of distilled water is required to be added in order to afford a utilizability of 1 : 100, = 2 oz. per gallon of syrup, for the requisite alcohol content of at least 42° underproof, after the necessary preservative has been added.

2. Distillation Without a Vacuum

This is carried out exactly like the vacuum distillation, but is naturally devoid of the advantages afforded by the latter; in particular, a greater loss of alcohol must be expected. When the kettle is not arranged for extraction, having no cover condenser, distillation must be proceeded with from the beginning, but otherwise under the same conditions of charging, of twice returning 10 gallons of distillate to the still, and then completing the distillation in the manner already described to obtain the like end result.

3. Working up of Residues

The flavor is unevenly distributed in fruits, and although the juice has a very fine flavor, it is not sufficiently strong in it, thus the 25 gallons of juice contain no more flavor than 50 lb. of fresh fruit contain. From this it follows that the major portion of the flavor

must reside in the residues deprived of the juice. Even though it is stated that the essences made from the residues are inferior in quality, it must be said that this is so only when during the course of manufacture the residues have been overheated, or were not fresh.

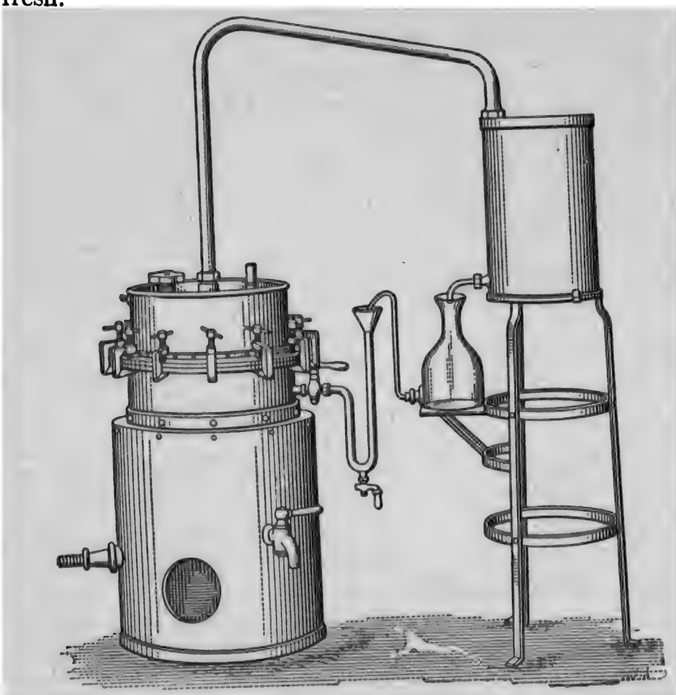


FIG. 31. Simple distilling apparatus.

Operating with a vacuum at a suitably low temperature, however, products are obtained equal in quality to those obtained from the whole fruit. The residues, however, must not be subjected to a secondary expression. The best mode of procedure is not to express the fruit at all, but to place the fruit, *e.g.*, berries, in comminuted form, in a cask provided with a sieve bottom, and to allow the virgin juice to run off, which it does to the extent of about 45%. This method is advantageous in so far as the juice may be utilized as such, and without influencing the quality of the essence. In this case, however, the residues from 400 lb. of whole berries, instead of 300 lb., must be taken. This applies also to the residues from all other fruits, only in every case the residue must be stirred with

water to make a mash the total weight of which must be about 300 lb., to make a charge for the kettle; the distillation is then proceeded with as already described, the essence obtained being at least equal in value to that obtained from the whole fruit, since relatively more fruit had been employed.

4. Extraction Methods

Extraction is only occasionally employed, and then only for such fruits as cannot be heated above 170° F. without injury, such as strawberries, which it is impossible to distil without the use of a vacuum. Lacking a vacuum pan, the following extraction method is employed: The fruit is first pressed, the juice thus obtained being utilized independently, because its water content renders it unadapted for concentration as it would too greatly dilute the alcohol required. Hence only the fruit residue is employed, it being mixed with double the quantity of alcohol of about 38° overproof, and allowed to stand for two days. The mixture is then expressed, and the liquid extract is employed for a new batch of fruit residue. Thus, were 50 lb. of strawberry residue taken, this would be treated with about 12 gallons of the alcohol; after expression about 15 gallons of extract would be obtained. This extract is now added to a new 50 lb. of fruit residue, which is expressed after two days, 15 gallons of a stronger extract being obtained, which again is added to 50 lb. of fresh strawberry residue, 15 gallons of extract being obtained for the third time. The three spent portions of residue are then mixed with about 60 gallons of water and distilled, the distillate being rectified down to about 10 gallons which are then added to the 15 gallons of extract already obtained. The essence so obtained has a utilizability of 2 : 100, *i.e.*, 4 oz. per gallon of lemonade syrup. A higher degree of concentration cannot be well obtained by this method; and the extract essence has an alcohol content of about 15° underproof.

In a similar manner essences are made from bananas and pineapples, and the modified methods required will be described under the fruits in question.

5. Isolating the Fruit Flavors (Aroma Oils)

In the case of these peculiar flavors it is the object to transfer the flavor, which has been rendered soluble, to a medium insoluble in alcohol and water; and for this purpose the best substance

is pure petroleum ether, which, above all, must be perfectly free from all foreign odorous substances. The object is effected by shaking out the flavoring, rendered soluble, and whether on hand in the form of fruit juices or extracts, or even distillates. The petroleum ether is insoluble in alcohol, neither does it dissolve any alcohol; it is, however, an excellent solvent for flavors of all kinds, and, being the better solvent, abstracts these from other solutions.

The flavor is first rendered soluble, for which purpose fruit residues are used, in order to render possible a concentration from the very start, as the water content of the juice would render illusory the utilization of any alcohol. On the other hand, the residual fruit juice may be subsequently subjected to a shaking out. For this purpose the fruit-juice residue is placed in a percolator cask, and strong alcohol is poured over it to cover it. After standing 24 hours percolation is allowed to proceed, strong alcohol being added until 25 gallons of extract are obtained from 100 lb. fruit; the percolation is then continued until a second 25 gallons are collected. The quantity of alcohol employed is immaterial, because it is subsequently regained. The residue is now transferred to the still and the alcohol distilled off as usual, whereby any flavoring still remaining is carried over in the distillate. This distillate is once more rectified, and the high percentage distillate may be used again with a new batch of material. We have now 25 gallons of primary, and 25 gallons of secondary, extract. With this last extract another 100 lb. of fruit residues are treated, obtaining 25 gallons of primary extract which is the more concentrated because it contains the flavor of the secondary extract together with the greater part of that of the freshly treated substance. Pouring on more alcohol, a secondary extract is again obtained, which, in turn, is used for a fresh batch of material as before; and this procedure may be repeated as often as desired, obtaining an always uniform extract consisting of primary percolates, for the manufacture of which the secondary percolates of the previously treated material are used. These percolates are now shaken with one-tenth their volume of petroleum ether in suitable vessels, whereby the greater part of the flavoring passes into the petroleum ether. The latter, after it has been allowed to collect on the surface of the liquid, is drawn off; the liquid is again shaken with a like quantity of petroleum ether as before,

and this second portion, when collected, is employed for shaking out a fresh portion of percolate. In this manner any flavoring not extracted during the first shaking out is utilized, and not allowed to be lost.

The petroleum-ether extract is now subjected to distillation, using a water-bath and a good condensing apparatus, so that the flavoring remains behind in the still, while flavor-free petroleum ether is obtained as a distillate. Should, however, any of the flavoring really pass over into the distillate it is regained, because the distillate is used for shaking out a fresh portion of percolate. The product obtained is small in quantity, and forms a viscid, dark, almost oily liquid, representing the isolated flavoring. It represents 2000 to 3000 times its weight of the fruit employed, *i.e.*, using about 3 tons of berries, the end result weighs about 2 lb. This product is now dissolved in five times its quantity of absolute alcohol, and is subjected to a freezing mixture, whereby wax is precipitated. On filtering, the filtrate forms the concentrated flavoring oil having a provisional strength 100 times greater than that of the $\frac{1}{2}$: 100 essence obtained by the vacuum process. For this it is, however, necessary that the fruit juice obtained in preparing the residues be in similar manner shaken out with petroleum ether, and that these extracts be distilled just like those obtained from the fruit residues. If, however, it is desired to avoid this labor, and utilize the juice to better advantage otherwise, the yield of flavoring oil will be about 25% less. Following the preceding operations it must be mentioned that the alcoholic extract of the residues, after having been shaken out with petroleum ether, are subjected to distillation in order to recover the alcohol, and should any flavoring really not have passed over into the petroleum ether, it remains in the alcohol and is hence utilized in the finished preparation. The whole process would appear at first sight to be inconvenient, but it is greatly simplified by the fact that through the reëmployment of the solvents, which are recovered after they have yielded up the flavoring, the processes are conducted with relatively small quantities of alcohol and petroleum ether, when the recovery of the solvents is always immediately practiced for carrying on the operation. The yield is never quite uniform, and neither is the strength, hence an evaluation is always necessary. If, as stated above, the average end product of 2 lb., obtained from 3 tons of fruit, when dissolved in alcohol, affords about 10 lb. of

flavoring oil, which, in turn, is about 100 times stronger than a ½ : 100 essence, then only 1 ounce of the flavoring oil would be required to flavor 50 gallons of syrup. This form of concentration is, however, very unhandy, and for this reason the various flavoring oils are alcoholic dilutions which are adapted to the prices to be charged and to their utilizability. Thus, by dissolving 1 oz. of the product in 6¼ lb. diluted alcohol, an aromatic essence is obtained approximately equal to a concentrated ½ : 100 essence, 1 lb. of which contains the flavoring from 6 lb. of fruit. For the sake of completeness it may be mentioned that the true *honey-aroma oil* may be obtained in the following manner: Genuine honey is dissolved in six times its quantity of diluted alcohol, and the mixture is then shaken with petroleum ether. The deflavored honey is then freed from alcohol by distilling off the latter, and is utilized as a honey surrogate. The yield of flavoring is however quite varied, and depends upon the quality of the honey operated upon.

On the whole the honey-aroma oils are justifiable for purposes of export to such countries as place a high duty on alcoholic essences; and also for the finer kinds of confectionery which require the use of flavoring in the most concentrated form possible in order to prevent the liquefaction of the sugar mass. When necessary, artificially made substances are also employed in addition.

SPECIAL METHODS FOR MAKING FRUIT ESSENCES

On the whole, the methods of manufacture have been fully described. There remains but to mention certain modifications and additions required for the individual fruits, as well as to make a few remarks regarding the character of the fruits to be employed.

A. Berries

1. Wild Berries

These comprise the well-known berries found in the woods, members of the Ericaceæ (Vaccinium). They are the huckleberries (Vaccinium Myrtillus L.) and the various cranberries (V. Vitis-Idæa L., Oxycoccus Oxycoccus MacM., etc.). They are less frequently used for making essences for lemonades. As their juices are very valuable, they are used by themselves,

more particularly in making fruit wines and marmalades, and hence only the fruit residues are worked up into essences. The flavoring afforded is not very distinctive, hence it is better if the fruit can be fermented before being worked up, whereby the flavor is fairly developed. It is quite sensitive to distillation, so that, considering the very small quantity developed, it is more advantageous to employ the extraction method. As a fixing agent for all these fruits it is advisable to use vanillin, of which 1 dram may be added to every 10 lb. of the ½ : 100 essence.

2. Most Important Cultivated Berries

Raspberries: This fruit unquestionably plays the greatest rôle in the lemonade industry. A notable difference exists between the garden or cultivated raspberry and the wild or mountain berry. With the former the yield of juice is relatively larger, although its acid content is smaller. For the preparation of essences, however, it is of greater advantage to use the wild fruit as its flavor is more decidedly pronounced. Raspberry essence is obtained exclusively by distillation. The following mixture is to be added to 1 cwt. of the ½ : 100 essence for fixing purposes:

Vanillin	¾ oz.
Ionone (10% solution)	½ "
Jasmine Oil (10% solution)	½ dr.
Benzyl Benzoate	5 oz.

Strawberries: With these also there is a difference between the cultivated and wild berries. The latter are the more aromatic and go farthest, but it is of the greatest importance that they be used when perfectly fresh, as they are exceedingly sensitive to fermentation. If fresh wild berries cannot be immediately worked up, it is preferable to use the cultivated fruit, only in this case the fruit should be small and of deep red color, and should be gathered in the morning before exposure to the sun's rays. The flavoring withstands distillation very poorly, and can only be obtained by aid of a vacuum. Otherwise the extraction method must be resorted to. For fixing, 1 cwt. essence requires the following:

Cumarin	¾ oz.
Nerolin	¾ "
Benzyl Benzoate	5 "

Currants: In the essence industry, the white currants scarcely ever come into question, while the red currants are utilized to a limited extent, although both are well utilizable in the manufacture of juices. Black currants, on the other hand, are excellently adapted for the manufacture of an essence, because, while in the fresh state the odor of the berries is pleasant, the odor, when the fruit is fermented, develops an exceedingly flower-like, vinous character, so that the black currant essence is highly prized as an addition to compounds which are to have a full bouquet. If an essence is to be made from red currants, at least one-third of the berries should be replaced by black currants in order to obtain an essence that will have utilizable flavor. For fixing 1 cwt. of such essence there will be required:

Vanillin	¾ oz.
Yara-Yara	¼ "
Ceylon Cinnamon Oil	2 dr.
Rose Oil	1 "
Ionone (10% solution)	5 "

Gooseberries: The aroma of these berries is not well developed, and is best observed in the fully ripe, highly colored berries, and far less in the green sort. In any case the flavor must be developed by fermentation, and the extraction method must be employed. For fixing 1 cwt. of the essence there will be required:

Cumarin	¾ oz.
Ionone (10% solution)	¼ "
Fennel Oil	1½ dr.
Rose Oil	1 "

Blackberry, European: This berry possesses a very fine flavor, which, however, requires for its development a preliminary fermentation. The essence is obtained by distillation, and for fixing it, 1 cwt. requires:

Vanillin	¾ oz.
Benzaldehyde	½ "
Heliotropin	½ "
Methyl Salicylate	5 dr.
Birch Tar Oil	2 "

3. The More Unusual Kinds of Berries

Garden Barberries, European Elder Berries, Juniper Berries, Mulberries and *European Mountain Ash Berries* are worked up like the wild berries, *i.e.*, by extraction methods, because of their

limited use. For fixing the essences made from them there is required 1 dr. vanillin for every 10 lb. of essence. *Grapes* are practically not at all worked up, or at the most only the dark red or blue sorts, and these, too, only by extraction methods, employing usually wine distillate instead of commercial alcohol, but no fixing agent.

B. Stone Fruits

The flavor of stone fruits is always fairly characteristic, but there is always present a suggestion of a bitter almond flavor, due to the kernel. For the manufacture of essence, however, the fruit must always be stoned, as the bitter almond flavor can always be imparted by means of benzaldehyde, and this is, moreover, provided for in the fixing, which in all cases requires the addition of $\frac{3}{4}$ oz. vanillin and $1\frac{1}{2}$ oz. benzaldehyde to every hundred weight of essence. The most important of these essences are those of the *apricot* and *peach*, which, however, in many cases are replaced by artificial flavors, replacing the apricot essence by methyl anthranilate, and peach essence by the odorous substance known as "*persicol.*" Otherwise it is usual to employ extraction methods as the flavors are very sensitive.

Cherries: The flavor is best developed in sweet, dark cherries, which bear distillation exceptionally well. The *Sour Cherries* (agriots) are almost exclusively used only in the manufacturing of juices.

Plums: The flower-like character of the plum flavor is advantageously utilized in the early ripening yellow and dark-blue kinds. The ordinary prunes are not at all utilizable. The flavor can well be obtained by distillation, and is advantageously developed by a preliminary fermentation.

C. Seed Fruits

Apples: It is most advantageous to use the highly yellow, small, early apples, or other kinds of highly-colored fall apples, because in these the flavor is most decidedly developed. If supplies of fresh apple peels are available, such as form a by-product in the manufacture of fine marmalades, such peels may be used with great advantage, as, because of their greater content of flavoring, 1 cwt. are equal in value to 3 cwt. of apples. The peels, however, can only be used when perfectly fresh, but when whole apples are used, they must first be thoroughly fermented by which means

only is the flavor fully developed. The apple essence does not bear fixing, although the flavor may be made more intense if, before the final distillation, 2 oz. amyl valerate are added to 1 cwt. of the essence to be obtained.

A good essence has also been made from dried apples, or better, from the apple peels obtained as a by-product in the manufacture of sliced, dried apples. The method of manufacture consists in first macerating 1 cwt. of the dried apples with 30 gallons of proof spirit. At the end of three days' maceration, the mass is transferred to a still, 30 gallons of water are added further, and distillation is carried out in vacuo to avoid any "baked" fruit taste, until 30 gallons of distillate are obtained. With the distillate 1 cwt. of apple peels is again similarly treated, so that on distillation about 30 gallons of a double-strength distillate is obtained, which is diluted with water to yield an end-result of 3 cwt., affording a 1 : 100 essence.

Pears: Of these, too, only the highly-colored yellow and red early fruit is used. The fruit is subjected to a preliminary fermentation, the essence being then obtained by distillation. For fixing, there are added to each hundred weight of essence 2 oz. vanillin and $\frac{1}{4}$ oz. neroli oil.

Quinces: Of these the pear-shaped fruit is to be preferred to the apple-shaped, and it is further necessary that the fruit should be allowed to dry for a long time, in order to fully develop the characteristic flavor. For fixing purposes, there is added $1\frac{1}{2}$ oz. vanillin to 1 cwt. of the essence. As a surrogate, a mixture of equal parts of pear essence and apple essence may be used.

D. Citrus Fruits

We have here to deal with essences obtained from members of the *Citrus* family. These essences are obtained only from the rinds, and only according to the method the general rules of which will presently be detailed. The essence must be free from terpenes, and must be miscible with water in all proportions. The flavor exhibits the peculiarity that it easily becomes rancid, the change being favored by the fruit acids, and it then acquires a turpentine- or soap-like taste. It is hence advisable not to keep the extract mixture or syrup in stock for any length of time. These essences will not stand fixing of any kind, although it may happen that they are fortified with terpeneless oils.

The rinds to be used should be thin, and should be obtained by means of a paring machine. A case of fruit — about 200 to 300 — yields about 11 lb. of rinds. These are to be fairly free from the white, parenchymatous portion, and they must be fresh, as they are prone to ferment easily, whereby their flavor will be impaired. Where the finds are to be kept for some time, particularly during transportation from source of supply to the essence manufacturer, and particularly during the hot season, it is advisable to immerse the rinds in a 10% sodium chloride solution, which in nowise impairs the flavor, and which needs simply to be poured off when about to work up the rinds.

Essences of the citrus fruits are also often made from the volatile oils, in which case only terpeneless oils are to be used, and according to the following formula:

Terpeneless Oil	3 dr.
Alcohol (strong)	10 oz.
Dissolve, and add Distilled Water	6 "

This essence has then a utilizability of 1 : 100, = 2 oz. per gallon of syrup. For making lemon essence, citral is frequently used, because it is a constituent, although not the most valuable, of lemon oil. The citral of the market is obtained from lemon grass, and can never afford a substitute for the pure lemon taste. Should it, however, be used, 2 dr. to 1 lb. diluted alcohol suffice to afford a 1 : 100 essence. For making the popular *Lime Juice and Soda Essence* the terpeneless oil of the West Indian oil of limes is used according to the preceding formula. The Italian oil of limes has an entirely different taste, resembling only that of refined lemons.

The citrus fruits here in question are the lemon, sweet and bitter orange, lime and mandarin orange. Regarding the last mentioned, it must be remarked that the fruit cannot easily be peeled, and the peels used must be removed by hand.

E. Exotic Fruits

Pineapples: Pineapples are most important in the lemonade industry, and because of its penetrating aroma, the West Indian fruit is to be preferred to the hot-house fruit. The flavoring is particularly rich in the leathery rind, whereas the juice, in spite of its agreeable taste, contains but little of the characteristic flavor. The fruit is peeled, and is then most advantageously

used in the preserve industry or for making pineapple juice. The pineapple essence is best made by comminuting the peel and treating it with double its quantity of strong alcohol, and allowing the mixture to stand for two days. The mass is then expressed, whereby an equal quantity of liquid extract is obtained. It is advantageous to treat the marc again with a like quantity of alcohol, and to express after standing for one day, utilizing the liquid thus obtained with another batch of fresh peels. For fixing, 2 dr. vanillin are added to every 10 lb. of the essence. The utilizability of the essence is restricted, being only 2 : 100, = 4 oz. per gallon of syrup. The distillability of the flavoring is likewise restricted, and the flavoring does not afford the taste of the fruit true to nature, hence it is not to be recommended.

Banana: Although formerly the highly aromatic peel was used, at the present time the extract is generally made from the fruit substance which, however, must not be unripe, nor yet overripe. The flavor is not distillable, hence exhaustion methods must be employed. A batch of the comminuted fruit substance is treated with double the quantity of strong alcohol, and the mixture expressed after two days. With this extract a fresh batch of fruit may be treated in order to concentrate the essence which then will have a utilizability of 2 : 100, = 4 oz. per gallon of syrup. For fixing, 2 dr. vanillin are added to every 10 lb. of essence.

Pomegranate: Of this only the fruit substance itself is used, this being very carefully freed from the leathery rind. The latter contains considerable tannin, which would completely spoil the naturally weak taste of the extract. In this case, too, only the expressed fruit is worked up, and by the extraction method. In any event, the flavor is exceedingly delicate, hence for those beverages designated as *grenadines*, it is usual to employ an artificial essence consisting chiefly of peach and strawberry.

F. Various Fruits

Among these are *melons* and *cucumbers*. In working these, the fully ripe fruit is thoroughly comminuted, and freed from juice by expression. The residue is then worked up by the extraction method to make an essence, of which that obtained from melons is fortified by the addition of 2 dr. vanillin to every 10 lb. No addition, however, is made to the essence from cucumbers.

ESSENCES MADE FROM OTHER PLANT PARTS

A. Celery and Rhubarb

Celery tubers are washed, comminuted and then strongly expressed. The residue is then worked up into an essence by the extraction method, as the delicate aroma is particularly unable to stand distillation. This also applies to rhubarb, of which the highly red stems are worked up, the stems being first softened with boiling water, then cut up, and strongly expressed. In this case, also, the extraction method is used, with the difference, however, that wine distillate is used instead of alcohol. With neither celery nor rhubarb is it necessary to add any fixing agent.

B. Hops and Malt

For making beer-like lemonades there is required as a basis a *malt essence*, which is made as follows: 50 lb. fresh, light-colored, kiln-dried malt, well comminuted, are mixed with 20 gallons of water to make a mash, which is then heated to 170° F., but not above 180° F. After one hour there are added 3 gallons of strong alcohol, after which 6 gallons of liquid are slowly distilled off and collected. A fresh batch of malt is now made into a mash as before, but instead of adding alcohol, the 6 gallons of distillate from the first batch are added, and the mixture is distilled, collecting the 6 gallons of distillate first received, which will have a utilizability of 1 : 100, = 2 oz. per gallon of syrup. The further details for making beer-like lemonades will be described further on.

Hop Essence. — This is a tincture made by treating dried hops with 10 times their quantity of proof spirit for 8 days.

C. Ginger and Sweet Woodruff

Ginger: The strongest is the unpeeled Jamaica ginger root. The characteristic taste is due to an extractive, which, however, is accompanied by a resin which may be separated by washing out with alkalies, as follows: 10 lb. of ginger root are treated with 3 gallons of cold water in which 1 lb. sodium bicarbonate has been dissolved. After one day, the dirty yellow extract is drawn off and discarded as worthless, and the residue well washed with plenty of water, say thrice with 5 gallons each time. When all the water has drained off, 2 gallons of strong alcohol are then poured over the residue, and the whole allowed to stand for three

days. Then 10 lb. of liquid are allowed to run off, after which 2 gallons proof spirit are added to the residue, and a second percolate of 10 lb. is collected. After this, water is poured on the marc, and a further 5-lb. percolate is obtained. The various percolates are mixed, affording 25 lb. of an essence of 2 : 100, = 4 oz. per gallon of syrup.

Under the name *gingerine* there is marketed a concentrated ginger extract for the manufacture of which the clearly soluble essence above described is used. In making it, the 25 lb. of essence are evaporated by distillation down to 3 lb., the alcohol being collected during the distillation. To the 3 lb. of residue so obtained, 2 lb. of the strong alcohol first distilled over are added for preservative purposes. These 5 lb. of extract are five times stronger than the above-described essence, and hence only ¾ oz. of it is required per gallon of syrup. The remainder of the alcoholic distillate is rectified, and used in making a new lot of essence.

Sweet Woodruff. — In the manufacture of lemonades an essence of woodruff, made from the fresh herb in blossom, is not strong enough, and furthermore is very prone to cause turbidity. Hence it is customary to use an artificial woodruff essence which is fully equivalent to the natural essence, in that the cumarin employed is a natural constituent of the sweet woodruff.

ARTIFICIAL WOODRUFF ESSENCE

(1 : 100, = 2 oz. per gallon syrup)

Cumarin	1 oz.
Hot Alcohol	15 "
Dissolve, then add	
Alcohol	2 lb.
Tincture Tonka Bean (1 : 5)	1 "
Distilled Water	6 "
	10 lb.

D. Essences for Stimulant Beverages

(Cacao, Chocolate, Cola, Coffee, Tea)

(*a*) *Cacao* (*so-called "Cocoa"*) *Essence* (4 oz. per gallon)

5 lb. of roasted, ground cacao beans are macerated with 2½ gallons proof spirit for three days, and then, with a final addition of 2 gallons of water, slowly distilled to afford a yield of 10 lb. essence, in which 1½ dr. vanillin are to be dissolved.

(b) Chocolate Essence (4 oz. per gallon)

Vanillin	½ dr.
Tincture Cinnamon	6 "
Tincture Cloves	12 "
Rum Essence	13½ "
Cacao Essence	12 oz.
	1 lb.

(c) Coffee Essence (4 oz. per gallon)

Ground Coffee (sharply roasted)	5 lb.
Cinnamon	4 oz.
Mace	5 "
Arrak	8 "
Alcohol (25° underproof)	2½ gal.

Macerate for three days, then distil slowly, with final addition of

Water	2½ gal.

to yield 10 lb. distillate.

(d) Cola Essence (2 oz. per gallon)

Macerate 1 part roasted cola nuts with 5 parts proof spirit, and then use the extract in the following mixture:

Pear Essence	½ oz.
Woodruff Essence	1½ "
Orange Essence	1½ "
Vanilla Lemonade Essence	1½ "
Cola Tincture (as above)	3½ "
Bitter Orange Essence	7½ "
	1 lb.

(e) Tea Essence (4 oz. per gallon)

Ceylon Tea	3 lb.
Dried Rose Leaves	½ "
Arrak	1 pint
Orange Flower Water	1½ lb.
Pineapple Essence	1½ "
Alcohol	2 "
Water	5 "

Macerate for three days, and, with the subsequent use of water, percolate off 10 lb. liquid, in which dissolve 1½ dr. vanillin.

E. Lemonade Essence from Volatile Oils and Artificial Odorants

(a) Bitter Almond Essence (2 oz. per gallon)

Benzaldehyde	¼ oz.
Alcohol	5¾ "
Distilled Water	10 "
	1 lb.

(*b*) *Honey Essence* (2 oz. per gallon)

Honey-flavor Oil	½ oz.
Alcohol	12½ "
Rose Water	3 "
	1 lb.

(*c*) *Rose Essence* (2 oz. per gallon)

Rose Oil	¼ dr.
Alcohol (warmed)	6 oz.

Dissolve, then add

Rose Water	3 oz.
Lemon Essence	3 "
Orange Essence	4 "
	1 lb.

(*d*) *Sarsaparilla Essence* (2 oz. per gallon)

Sassafras Oil	½ oz.
Alcohol	10½ "
Distilled Water	5 "
	1 lb.

(*e*) *Vanilla Essence* (2 oz. per gallon)

Vanillin	4 dr.
Alcohol	6 oz.

Dissolve, then add

Tincture Tonka	¾ "
Distilled Water	9 "
	1 lb.

(*f*) *Violet Essence* (2 oz. per gallon)

Tincture Orris Root	1½ oz.
Ionone (10%)	¼ dr.
Alcohol	6 oz.
Water	8½ "
	1 lb.

COMPOSITION OF LEMONADE ESSENCES

These comprise a number of fancy lemonades made partly from fruit essences, partly with the aid of artificial substances. The utilizability of all of them is 2 oz. per gallon of syrup.

(a) Artificial Fruit Flavors

1. Grenadine Essence

Vanilla Essence	2 oz.
Peach Essence	3½ "
Strawberry Essence	10½ "
	1 lb.

2. Currant Essence

Peach Essence	2 oz.
Black Currant Essence	14 "
	1 lb.

3. Lime Essence

Orange Essence	
Strawberry Essence	
Raspberry Essence	
Lemon Essence	equal parts

4. Messina Fruit Essence

Lemon Essence	4 oz.
Bitter Orange Essence	4 "
Sweet Orange Essence	8 "
	1 lb.

5. Nectarine Essence

Apricot Essence	4 oz.
Peach Essence	4 "
Strawberry Essence	8 "
	1 lb.

6. Tutti-Frutti Essence

Rum Essence	2 oz
Raspberry Essence	2 "
Strawberry Essence	2 "
Lemon Essence	4 "
Pineapple Essence	6 "
	1 lb.

(b) Artificial Fruit Cups

7. Champagne Fruit Cup

Rum Essence	1½ oz.
Strawberry Essence	2 "
Raspberry Essence	2½ "
Lemon Essence	3 "
Pineapple Essence	7 "
	1 lb.

8. Swedish Fruit Cup

Vanilla Essence	1 oz.
Strawberry Essence	3 "
Grape Essence	4 "
Arrak Essence	8 "
	1 lb.

9. Cold Duck

Strawberry Essence	4 oz.
Pineapple Essence	4 "
Rum Essence	8 "
	1 lb.

(c) Artificial Wine Flavors

Basic Essences for Wine Lemonades

10. Claret Essence

Ambergris Tincture	¼ dr.
Ethyl Acetate	3¾ "
Carob Tincture	8½ oz.
Cherry Juice	7¼ "
Krameria Tincture	4 lb.
Wine Distillate	5 "
	10 lb.

11. White Wine Essence

Cognac Oil	10 dr.
Ethyl Nitrite	22 "
Ethyl Acetate	1½ oz.
St. John's Bread Tincture	12½ "
Wine Distillate	4½ lb.
Water	4½ "
	10 lb.

12. Port Wine Essence

Ambergris Tincture	¼ dr.
Ethyl Acetate	7¾ "
Krameria Tincture	1½ oz.
Elder Flower Tincture	2 "
St. John's Bread Tincture	3 "
Carob Tincture	3 "
Cacao Essence	3 "
Wine Distillate	3 "
	1 lb.

Artificial Cider Lemonades

13. Apple Cider

Port Wine Essence	½ oz.
Currant Essence	1 "
White Wine Essence	4 "
Apple Essence	10½ "
	1 lb.

14. Apricot Cider

Currant Essence	3 oz.
Apricot Essence	6 "
Wine Distillate	7 "
	1 lb.

15. Currant Cider

Port Wine Essence	3 oz.
Wine Distillate	4 "
Black Currant Essence	9 "
	1 lb.

16. Peach Cider

Wine Distillate	3 oz.
Apple Essence	5 "
Peach Essence	8 "
	1 lb.

Artificial Champagne Lemonades

17. Champagne Lemonade

White Wine Essence	1½ oz.
Port Wine Essence	1½ "
Wine Distillate	6 "
Proof Spirit	7 "
	1 lb.

18. "Civilsekt"

Bitter Almond Water	1½ oz.
Pineapple Essence	1½ "
Currant Essence	3 "
Wine Distillate	4½ "
Proof Spirit	5½ "
	1 lb.

19. Champagne Lemonade a la Jacqueron Fils

Violet Lemonade Essence	½ oz.
Grape Essence	2 "
Elder Flower Tincture	3 "
Wine Distillate	4½ "
Proof Spirit	6 "
	1 lb.

20. Champagne Lemonade a la Veuve Cliquot

Apricot Essence	½ oz.
Vanilla Essence	1¼ "
Currant Essence	1½ "
Wine Distillate	3 "
Proof Spirit	9¾ "
	1 lb.

Artificial Wine Flavors

21. Claret Lemonade

Clove Tincture	3 dr.
Cinnamon Tincture	5 "
Claret Essence	2 oz.
Cherry Juice	5½ "
Red Wine	8 "
	1 lb.

22. Muscatel Lemonade

Honey Lemonade Essence	½ oz.
Claret Essence	2 "
Port Wine Essence	3 "
Grape Essence	10½ "
	1 lb.

23. Nectar Lemonade

Honey Lemonade Essence	¼ oz.
Rum Essence	1¾ "
Port Wine Essence	3 "
Currant Essence	3 "
Apple Essence	8 "
	1 lb.

24. White Wine Lemonade

For making these there is employed the essence described as white wine essence.

Artificial Punch Lemonades

25. Claret Punch Lemonade

Rum Essence	1 oz.
Claret Lemonade Essence	15 "
	1 lb.

26. Swedish Punch Lemonade Essence

Vanilla Essence	1 oz.
Arrak Essence	5 "
White Wine Essence	10 "
	1 lb.

(d) Artificial Beer-Like Beverages

Malt essence is used as the basic material for making these beverages. The bitter taste is imparted by hop essence, and for those of very bitter taste, gentian tincture is used. All these beverages are made from extracts, which contain considerable burnt sugar, the caramel-taste of which is necessary in order to simulate that of beer. The following formulas are those of ex-

tracts of which 20 oz. are required per gallon of beverage. This is apparently a rather high proportion, but it will be found that instead of the 1½ oz. usually required of the various syrups for a 12-oz. bottle, only ¾ oz. of this syrup is required when bottling with carbonated water at a pressure of two atmospheres, in order not to impart too sweet a taste to the resulting lemonade.

27. Ginger Beer Extract

Caramel	3	lb.
Foam Essence	1	"
Citric Acid Solution	1	"
Malt Essence	½	"
Ginger Essence	⅝	"
Orange Flower Water	¼	"
Gentian Tincture	⅛	"
Water	3½	"
	10	lb.

28. Malt Lemonade

Caramel	4	lb.
Water	2½	"
Foam Essence	1	"
Citric Acid Solution	½	"

Mix, and add

Malt Essence	1½	"
Honey Lemonade Essence	2	oz.
Carob Tincture	14	"
	10	lb.

29. Mead Lemonade

Caramel	6	lb.
Malt Essence	2	"
Hop Essence	8	oz.
Gentian Tincture	10	"
Citric Acid Solution	12	"
Honey Lemonade Essence	2	"
	10	lb.

30. Dark Beer Lemonade (Münchener)

Caramel	6	lb.
Foam Essence	1½	"
Malt Essence	1	"
Citric Acid Solution	1	"
Gentian Tincture	3	oz.
Hop Essence	3	"
Honey Lemonade Essence	1	"
Peach Essence	1	"
	10	lb.

31. Light Beer Lemonade (Pilsener)

Caramel	3 lb.
Foam Essence	1½ "
Malt Essence	1 "
Citric Acid Solution	1¼ "
Hop Essence	¼ "
Water	3 "
	10 lb.

(e) Various Fancy Lemonades

32. Ambrosia Lemonade

Vanilla Essence	4 oz.
Strawberry Essence	4 "
Raspberry Essence	8 "
	1 lb.

33. Bicyclist Lemonade

Peppermint Oil (Mitcham's)	⅛ dr.
Alcohol	2 oz.
Imperial Lemonade Essence	14 "
	1 lb.

34. Crystal Spring (for Colorless Lemonades)

Black Currant Distillate	6 oz.
Lemon Essence	10 "
	1 lb.

35. Imperial Lemonade

Currant Essence	1¼ oz.
Peach Essence	2¾ "
Orange Essence	12 "
	1 lb.

36. Marchpane Lemonade

Apricot Essence	1½ oz.
Peach Essence	2½ "
Raspberry Essence	2½ "
Coffee Essence	2½ "
Cacao Essence	3 "
Wine Distillate	4 "
	1 lb.

37. Maraschino Lemonade

Rose Lemonade Essence	1 oz.
Cinnamon Tincture	1 "
Raspberry Essence	3 "
Wine Distillate	6½ "
Bitter Almond Water	4½ "
	1 lb.

38. Oriental Lemonade

Currant Essence	6 oz.
Maraschino Essence	10 "
	1 lb.

39. Victoria Lemonade

Pineapple Essence	2½ oz.
Strawberry Essence	2½ "
Cherry Essence	5½ "
Raspberry Essence	5½ "
	1 lb.

(f) Ferruginous Lemonades

For making these only the following lemonade extract is used, in the proportion of 10 oz. per gallon of syrup:

40. Iron Lemonade Extract

Tartaric Acid Solution	4¼ lb.
Foam Essence	1 "
Orange-yellow Coloring Solution	1 "
Soluble Ferric Oxide, Saccharated	6½ oz.
Water	2¼ lb.
Fruit Essence (Raspberry, Peach, etc.)	1 "
	About 10 lb.

The iron content is about 0.003% iron, equivalent to about ⅓ grain per 12-oz. bottle.

Instead of the above-mentioned iron compound, 5 oz. of iron lactate may be taken.

(g) Lactic Acid Lemonades

41. For these any desired essence may be used. The product is used only in the form of an extract, every 10 lb. of which contains 3 lb. lactic acid, 5 lb. water and 2 lb. of the desired essence, 10 oz. of the extract being used per gallon of syrup. The lactic acid beverages are usually colorless.

NON-ALCOHOLIC BEVERAGES

It is not the object of the non-alcoholic beverage industry to include all the material offered by the beverage manufacturing industry; it, however, includes imitation liqueurs, punches, wines and beers. The value of the genuine liqueurs depends upon their alcoholic content, whether directly added or resulting from fermentation processes. The purpose of the liqueurs is to stimulate the appetite and digestion, and this stimulation is due exclusively to the alcohol present. Since artificial liqueur essences

possess neither stimulant nor appetizing properties, non-alcoholic liqueurs made from them really have no good reason for their existence. At most non-alcoholic fruit liqueurs may be recommended as refreshing additions to water, carbonated water or milk. For this purpose all kinds of fruit flavors are suitable, and they really constitute only lemonade syrups.

NON-ALCOHOLIC FRUIT FLAVOR

Lemonade Essence (any kind)		2 oz.
Citric Acid Solution (1 : 1)		1 "
Sugar Syrup (60%)	to make	1 gal.

A number of other imitation non-alcoholic beverages may be made with the aid of liqueur essences provided these are soluble in water, *e.g.*, anisette, curaçao, maraschino, etc. (see Essences of the Alcohol Industry).

The so-called non-alcoholic bitters have proved to be failures, because they never fulfill their purpose. Should it be desired to make them, however, a rather large quantity must be employed in order to keep within the alcohol limit. For this purpose 2 lb. of any desired bitters essence are diluted with 5 lb. syrup and 4 lb. water, and the mixture is evaporated down to 10 lb. with constant stirring, in order to reduce the alcohol content. The concentrate is then filtered, and used in the proportion of 1 pint per gallon.

Non-Alcoholic Punch Essences

The effect of *non-alcoholic hot beverages* on the taste results from the employment of fine brandies or artificial brandy essences, but the beverages must be taken hot.

The following formulas give the composition of the so-called *non-alcoholic punch extracts*, and afford essences of which 2 oz. are used per gallon of syrup. One part of the finished *punch syrup* is to be mixed with 3 to 4 parts of hot water. If it is desired to impart a wine-like character to the beverages, the ordinary sugar syrup is replaced by cherry syrup.

1. Arrak Punch Essence

Arrak Essence	2 oz.
Genuine Arrak	1½ "
Lemon Essence	1 "
Vanilla Essence	½ "
Citric Acid Solution	¼ "
Water	10¾ "
	1 lb.

2. Claret Punch Essence

Claret Essence	2 oz.
Rum Essence	1½ "
Arrak Essence	2 "
Vanilla Essence	½ "
Jamaica Rum	2 "
Citric Acid Solution	1½ "
Cherry Juice	6½ "
	1 lb.

3. Coffee Punch Essence

Coffee Essence	4 oz.
Arrak, Genuine	1½ "
Port Wine Essence	½ "
Cinnamon Tincture	⅛ "
Vanilla Essence	¼ "
Orange Essence	1⅛ "
Lemon Essence	½ "
Citric Acid Solution	1 "
Caramel Solution (1 : 1)	7 "
	1 lb.

4. Cognac Punch Essence

White Wine Essence	4 oz
Genuine Cognac	2½ "
Lemon Essence	1 "
Vanilla Essence	¼ "
Citric Acid Solution	¼ "
Water	8 "
	1 lb.

5. Fruit Punch Essence

The various fruits adapted for this are the pineapple, orange, lemon, strawberry, mandarin and peach.

Lemonade Essence (any)	6½ oz.
Arrak Essence	1½ "
Citric Acid	1½ "
Water	5 "
Genuine Arrak	1½ "
	1 lb.

6. Mulled Punch Essence

Red Wine Essence	3 oz.
Raspberry Essence	2 "
Cinnamon Tincture	1 "
Clove Tincture	1½ "
Orange Essence	2 "
Citric Acid Solution	1½ "
Cherry Juice	5 "
	1 lb.

7. Imperial Punch Essence

Tea Essence	4 oz.
Genuine Arrak	1½ "
Red Wine Essence	½ "
Vanilla Essence	½ "
Citric Acid Solution	1 "
Cherry Juice	8½ "
	1 lb.

8. Rum Punch Essence

Rum Essence	3½ oz.
Jamaica Rum	1½ "
Lemon Essence	1 "
Vanilla Essence	½ "
Citric Acid Solution	1½ "
Caramel Solution (1 : 1)	8 "
	1 lb.

9. Swedish Punch Essence

Arrak Essence	2 oz.
White Wine Essence	2 "
Genuine Arrak	2 "
Orange Essence	1 "
Water	9 "
	1 lb.

NON-ALCOHOLIC BEERS AND WINES

These designations, strictly speaking, are absurd, because beer and wine are products of alcoholic fermentation, and only thereby is the characteristic taste developed, a taste which is originally present neither in the grape juice nor in the malt mash. In preparing such non-alcoholic beverages, therefore, the alcohol must be removed by distillation. In doing this, however, all volatile flavoring matters pass over with the distillate, and the beverage is valueless so far as its taste is concerned. To render the taste more acceptable, the alcohol lost is replaced by a more or less concentrated syrup, and lastly, in order to render the beverage stable, the latter must be sterilized. Moreover, however desirable it may be to supply the public with non-alcoholic beverages, there is practically no demand for them.

A so-called non-alcoholic beer has also been made by boiling malt and hops, filtering the extract, sterilizing and then charging with carbon dioxide gas. However, this beverage does not meet

the requirements demanded for general use, so that the lemonade-like beverages having a wine or beer flavor are to be preferred.

THE CONTENT OF ACID IN EXTRACTS AND SYRUPS FOR LEMONADES, AND THEIR USUAL COLORING

The numbers give the pounds of dissolved acid to be employed for 10 lb. lemonade extract 5 : 100, = 10 oz. to a gallon syrup, and also how many ounces are necessary for 1 gallon syrup.

The acids (citric or tartaric acid) are used as solution 1 : 1. The colors may be used in any concentration or tint as usual.

(*a*) Fruit Lemonades

Sorts.	Acid solution.	Color.	Sorts.	Acid solution.	Color.
Agriots........	2	red	Melon.............	2	yellow
Apple.........	3	caramel	Mirabelle.........	2	"
Apricot.........	2	yellow	Mossberry.........	2½	red
Banana..........	1½	"	Mulberry..........	2	light-red
Berberry.........	2	red	Orange, bitter.......	2½	orange
Bilberry, black..	2	dark-red	Orange, sweet....	2	"
Bilberry, red ...	2½	red	Peach..........	2	"
Blackberry......	2	"	Pear...........	1½	light-yellow
Cherry......	2	"	Pineapple.......	1½	" "
Cranberry	2½	"	Plum............	2	yellow
Cucumber.........	1½	colorless	Pomegranate.....	1½	grenadine
Currant	2	red	Quince..........	2	yellow
Elderberry	1½	dark-red	Raspberry..........	1½	red
Gooseberry.........	2	light-yellow	Green Gage........	2	yellow
Juniper............	1½	yellow	Sorbberry...........	2	orange
Lemon	2½	"	Strawberry.........	1½	red
Lime.............	2½	"	Tangerine...........	2	orange
Lime Juice and Soda	2½	"	....	......	....

(*b*) Lemonades with the Taste of Other Plant Parts

Sorts.	Acid solution.	Color.	Sorts.	Acid solution.	Color.
Bitter Almond	1½	colorless	Malt	1	brown
Celery............	1½	"	Rhubarb............	2	light-green
Chocolate.........	1	dark-brown	Rose................	1	light-rose
Cacao............	1	"	Sarsaparilla.........	1½	light-yellow
Coffee............	1	"	Tea.................	1	brown
Ginger............	1½	light-yellow	Vanilla..............	1	"
Honey............	1	yellow	Violet	1	light-yellow
Hop..............	1½	"	Woodruff............	1½	green
Cola Nut..........	2	brown	....	......	....

(c) Fancy Lemonades

Formula No.	Sorts.	Acid solution.	Color.	Formula No.	Sorts.	Acid solution.	Color.
32	Ambrosia	2	red	2	Grosseille	2	"
				35	Imperial	1½	"
13	Apple Cider	2½	light-yellow	40	Iron Lemonade	2	brown
				3	Limetta	2	orange
14	Apricot Cider	2	yellow	28	Malt	1	brown
30	Beer, dark	1	brown	37	Maraschino	1	colorless
31	Beer, light	1	yellow	36	Marchpane	1½	yellow
				4	Messina Fruits	2	orange
33	Bicyclist	1½	colorless	29	Mead	1½	yellow
17	Champagne	2	"	41	Milk	(Lactic Acid)	colorless
18	Civilsekt	2	"				
19	Jacqueron	2	"				
20	Veuve Cliquot	2	"	22	Muscade Wine	1½	yellow
7	Fruit Cup	2	"	23	Nectar	1½	"
21	Claret Lemonade	1½	red	5	Nectarine	2	"
25	Claret Punch Lemonade	1	red	38	Oriental	2	red
				16	Peach Cider	2	orange
9	Cold Duck	2	colorless	8	Swedish Fruit Cup	2	yellow
34	Crystal Spring	2	"	26	Swedish Punch Lemonade	1½	colorless
15	Currant Cider	2	red	6	Tutti Frutti	2	red
27	Ginger Beer	1	light-yellow	39	Victoria	2	"
1	Grenadine	2	red	24	White Wine	2	colorless

PART V

THE MANUFACTURE OF LIQUORS, LIQUEURS, SPIRITS AND OTHER ALCOHOLIC BEVERAGES

GENERAL METHODS OF DISTILLERY PRACTICE

Kinds of Spirits (industrial and genuine spirits).
Employment of Vegetable Products.
Methods of Extracting (Digestion, Maceration and Percolation).
Employment of Volatile Oils.
Distillation of Drugs for Spirits.
Compounded Volatile Oils (Liqueur Oils).
Composition of Alcoholic Beverages.
Storage and Ageing of Liquors.

Special Manufacture of Essences for Brandies, Liquors and Liqueurs

I. ALCOHOLIC BEVERAGES WITH PREDOMINANT TASTE OF VOLATILE FLAVORS

(a) Citrus Fruits

1. Barbadoes Liqueur.
2. Bergamot.
3. Bishop Liqueur.
4. Curaçao, Dutch.
5. " French.
6. Lemon Liqueur.
7. Spiced Lemon Liqueur.
8. Bitter Orange Liqueur.
9. Bitter Orange.
10. Sweet Orange Liqueur.
11. Mandarin Liqueur.

Compounded Liquor Oils:

12. Bergamot.
13. Curaçao, Dutch.
14. " French.
15. Lemon.
16. Spiced Lemon.
17. Orange, Bitter.
18. " Sweet.
19. Mandarin.

(b) Weak Spices with Volatile Character only

Anise:

20. Anise Essence.
21. Anise Essence.
22. Anisette, Dutch.
23. " French.
24. Fennel Essence.
25. Rostopschin Essence.
26. Star Anise Essence.
27. Anisette Liqueur Oil, Dutch.
28. " " " French.
29. Rostopschin " ".

Caraway:

30. Caraway Essence.
31. " Essence.
32. Double Caraway Essence.

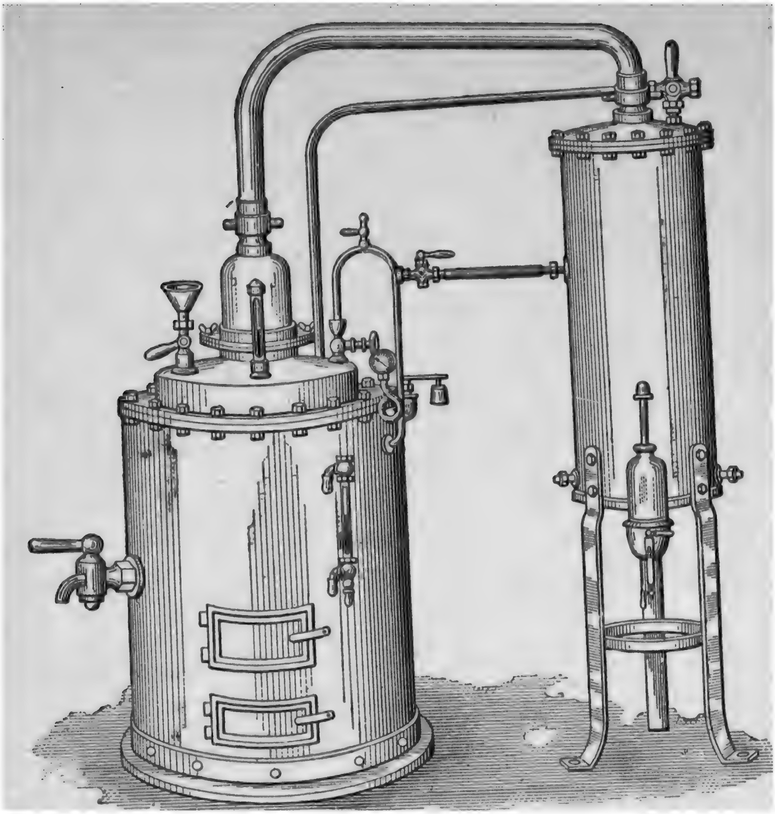


FIG. 32. Apparatus for distilling essences, and using coal as fuel.

33. Russian Caraway Essence (Allasch).
34. Caraway Liqueur Oil.
35. Double Caraway Liqueur Oil.
36. Rostopschin " ".
37. Crystallized Caraway Liqueur.

Juniper:

38. Juniper Essence.
39. " Essence.
40. Geneva, Dutch.
41. Gin, Irish (Old Tom).
42. Steinhaeger Essence.
43. Geneva Liqueur Oil.
44. Juniper " ".
45. Steinhaeger " ".

Mint:

46. Balm Mint Essence.
47. Peppermint Essence.
48. Double Peppermint Essence.
49. Balm Mint Liqueur Oil.
50. Peppermint " "

(c) *Stronger Spices, partly with Extract Aroma*

Absinthe:

51. Absinthe, Swiss.
52. " Essence, French.
53. " " German.
54. Hyssop Essence.
55. Liqueur Oil, French.
56. " " German.
57. " " Swiss.

Calamus:

58. Calamus Distillate.
59. " Essence.
60. Calmuser Essence.
61. Calamus Liqueur Oil.

Celery:

62. Celery Essence.
63. " Essence.
64. " Liqueur Oil.

Cinnamon:

65. Cinnamon Essence.
66. " " white.
67. " Flower Essence.
68. " Liqueur Oil.

Cloves:

69. Clove Essence.
70. Rosoglio Essence.
71. Rosoglio Liqueur Oil.

Ginger:

72. Ginger Essence from Root.
73. " " " Oils.
74. Stomachic Ginger Essence.
75. Ginger Liqueur Oil.

Spices:

76. Spice Liqueur Oil.

Vanilla:

77. Vanilla Essence, Genuine.
78. Vanillin Essence.

Composition of Liqueurs with Predominant Flavor.

II. THE EMPLOYMENT OF FRESH FRUITS FOR SPIRITS AND LIQUEURS

Fruit Liqueurs and Ratafias.
Genuine Fruit Spirits and their Imitations.

(*a*) *Stone Fruits*

Cherry:

1. Cherry Juice and Syrup.
2. Genuine Cherry Brandy.
3. Cherry Ratafia.
4. Cherry Fruit Liqueur.
5. " Brandy Liqueur.
6. Maraschino di Zara.
7. " di Casalo.
8. Genuine Cherry Flavor.
9. Artificial Agriot Brandy.
10. " Cherry Brandy.
11. " Maraschino Essence.
12. " " Zara type.
13. Cherry Liqueur Essence.
14. Spiced Cherry Essence.

Plum:

15. Artificial Plum Brandy.
16. " Sliwowitz.
17. La Prunelle.

Bitter Almond Character:

18. Apricot Essence.
19. Bitter Almond Essence.
20. Almond Essence.
21. Macaroon Essence.
22. Persico Essence.
23. Peach Essence.

Walnut:

24. Walnut Essence from Unripe Nuts.
25. " " Artificial.

Liqueur Oils:

26. Spiced Cherry.
27. Nalewka.
28. Maraschino.
29. Sliwowitz.
30. Persico.
31. Walnut.

(*b*) *Kernel Fruits*

32. Imperial Pear Essence.
33. Muscade " "

(*c*) *Berries*

34. Raspberry Distillate.
35. " Flavor from Juice.
36. Raspberry Liqueur.
37. " Table Liqueur.

38. Bilberry Essence, black
39. " " red.
40. Wild-fruit Composition.

Supplement:

41. Banana Essence.
42. Pineapple Essence.

Composition of Liqueurs with Fruit Taste.

III. SPIRITS WITH LEADING EXTRACTIVE FLAVOR

(*a*) *Woodruff*

1. Woodruff Essence, Genuine.
2. " " Artificial.

(*b*) *Stimulants*

3. Coca Leaf Essence.
4. Cacao Essence, brown.
5. " " colorless.
6. Chocolate Essence.
7. Coffee Essence, brown.
8. " " colorless.
9. Cola Nut Essence.
10. Tea Essence.

Composition of Liqueurs with leading Extractive Flavor.

IV. AROMATIC WATERS

Volatile Oils as Raw Materials.
Vegetable Distillates from Drugs.
Mixed Essences.

(*a*) *From Volatile Oils.*

1. Alkermes.
2. Captain Water.
3. Danzig Cordial.
4. Cordial Medoc.
5. Danzig Gold Water.
6. Munich Railway Liqueur.
7. Riga Balsam.
8. Sergeant Liqueur.
9. Water Cress Liqueur.

French Specialties:

10. Eau Céleste.
11. " des Favorites.
12. " de la Côte.
13. Parfait d'Amour.

Bitter Specialties:

14. Bavarian Herb Liqueur.
15. Berlin Double Bitter.
16. Danzig Cordial Drops.
17. Elixir de Spaa.
18. Kontuszowka.
19. White Stomach Water.

(*b*) *Vegetable Distillates*

20. Danzig Golden Water.
21. " Baal Water.
22. Carmelite Water.
23. Christophelet.
24. Danzig Cordial.

French Specialties:

25. Eau de Batave.
26. " " Bouquet.
27. Eau de Fantaisie.
28. " d'Orient (Eskubak).
29. " de Paradise.
30. " " Portugal.
31. " " Sultan.
32. " Divine.
33. " Parfait d'Amour.

Bitter Specialties:

34. Bertram Bitters.
35. Brahma Bitters.
36. Carminative Liqueur.
37. Danzig Cordial.
38. Greek Bitters.
39. Krambambuli.

59. Calisaya Bitters.
60. Root Bitters.
61. Seamen Bitters.
62. Samaritan Bitters.

From Drugs and Oils:

63. Black Bitters.
64. Giant Bitters.
65. Green Bitters.

(d) Compound Liqueur Oils

66. Aromatique.
67. Benedictine.
68. Carlsbad Bitters.
69. Chartreuse.
70. Cholera Bitters.
71. Electoral Bitters.
72. English Bitters.
73. Fine Bitters.
74. Hunt Bitters.
75. Spanish Bitters.
76. Swiss Alpine Herb Bitters.
77. Universal Bitters.

Table of Composition of Bitter Liqueurs.

VI. TYPES AND IMITATIONS OF GENUINE BRANDIES

(a) Grain Liquors

1. Nordhausen Type.
2. Silesian Corn Spice.
3. Westphalian Type.
4. Wheat Corn Type.
5. Aquavit Liquor Oil.
6. Whisky Type.

(b) Rum

7. Rum Ether, Simple.
8. Concentrated Rum Ether.
9. Rum Flavor.
10. Base for Artificial Rum, Jamaica Type.
11. Base for Common Rum.
12. Artificial Rum.

(c) Arrac

13. Arrac Flavor.
14. Base for Artificial Arrac, Batavia.
15. " " " " Goa.
16. Artificial Arrac.

(d) Cognac

17. Cognac Type (Charente).
    Typage.
    Syrupage.
    Syrup Charentais.
18. Cognac from Syrup Charentais.
19. Cut Cognac.
20. Base for Cut Cognac.
21. Artificial Cognac Essence.
22. Egg Cognac.
23. Imitation Egg Cognac.

(e) Supplement: Stomachic Wines

24. Wormwood Wine (Vermouth).

VII. ALCOHOLIC HOT DRINKS (GROG AND PUNCHES)

1. Spice Flavor for Punch.

(a) With Taste of Genuine Liquors.

2. Grog Extract; Arrac, Cognac or Rum.
3. Grog Extract; from artificial Brandy.
4. Punch Extract; Arrac, Cognac or Rum.
5. Punch Extract; from artificial Brandy.
6. Toddy Extract from Whisky.
7. Warm Corn Extract.

(b) Fruit Punches

8. Lemon, Orange and Pineapple.

(c) Fancy Punches

9. Coffee or Tea Punch.
10. Milk Punch.
11. Royal Punch.
12. Russian Kaskantschi Punch.
13. Swedish Punch.

(*d*) *Wine Punches*

14. Bishop.
15. Burgundy Punch.
16. Cardinal.
17. Claret Punch.
18. Glowing Wine Punch.
19. Imperial Punch.
20. White Wine Punch.

(*e*) *Imitation Wine Punches*

21. Flavor Essence for Glowing Punch.
22. Glowing Punch.

PART V

THE MANUFACTURE OF LIQUORS, LIQUEURS, SPIRITS AND OTHER ALCOHOLIC BEVERAGES

KINDS OF SPIRITS (INDUSTRIAL AND GENUINE SPIRITS)

Liquor in general, as used for drinking purposes, is a liquid manufactured by distilling fermented vegetable substances containing sugar, or starch transformed into fermentable sugar, or other similar substances. The result of the fermentation by the yeast organism is the splitting up of sugar into alcohol and carbon dioxide, with the formation also of by-products such as glycerin, volatile homologues of alcohol, fusel oil and some less important substances.

The raw spirit so obtained is purified, primarily because the first distillate is not strong in alcohol and must be rectified to a higher alcoholic strength, and secondly, because the impurities must be removed, usually by means of charcoal. In the rectification the lower-boiling portions, as aldehydes, are separated, and the fusel oil is removed by filtration through charcoal. Pure alcohol has of itself no special flavor, but it has a flavor in those cases where a natural content of higher alcohols is peculiar to certain kinds, as in the genuine brandies, like grain brandy, fruit brandy or wine brandy, rum, etc. The quality of *industrial spirit* depends upon the content or absence of fusel oil, and for purposes of the distiller that containing the least quantity of such fusel oil is preferred.

The genuine brandies, as grain spirit, fruit spirit, arrac, wine brandy and rum, are those which are named according to the special raw materials from which they are made; thus industrial spirit is made especially from potatoes, maize or, in the rarer cases, from wood. Corn whisky (grain whisky) is distilled from mashed and fermented rye, wheat, barley or even buckwheat. Its valuable constituents are distinct fusel oils with an agreeable taste. Grain liquors are drunk as delivered from the still, or aromatized.

The content of sugar of every fruit makes the latter suited for fermentation, and in cases of high sugar content, as in cherries and plums, it is quite sufficient. In cases where there is insufficient sugar, the manufacture would not pay the expenses, there-

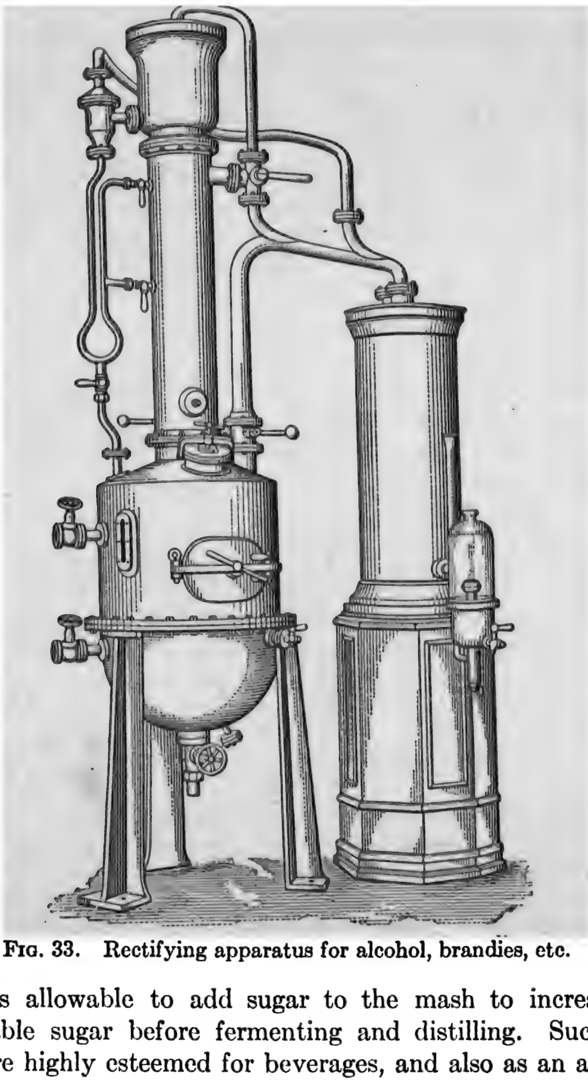


FIG. 33. Rectifying apparatus for alcohol, brandies, etc.

fore it is allowable to add sugar to the mash to increase the fermentable sugar before fermenting and distilling. Such fruit spirits are highly esteemed for beverages, and also as an addition to some kinds of liqueurs. Gentian root and juniper berries are also well adapted for the manufacture of brandies, because of

their content of sugar. The strength of the alcohol varies, but it is usually desired to be about 5 to 7° underproof on the average. If higher degrees are manufactured, the dilution to lower degrees is allowed by adding distilled water.

Rum is a product of the fermentation of by-products of the sugar-cane industry. However, in the countries of production some unknown drugs are added to develop the special type of genuine rum, as it would be impossible to manufacture rum from cane sugar only. The product of distillation is colorless, but it is colored by caramel (burnt sugar), and stored for a long time for ageing purposes.

Arrac is made chiefly from the fermented juice of the palm, which yields most juice when the flower stems are cut. A juice rich in sugar is thus obtained, and on fermentation yields a product called "Toddy"; this when distilled, is arrac. Sometimes rice mash is added, and certain vegetables to give the distillate the right type desired.

A product particularly well liked is that obtained by distilling wine, the genuine *wine brandy*, the raw material for Cognac. Its quality depends upon the quality of the wine itself.

The distillation products of such fermentation from various raw materials are called *genuine brandies.* If diluted with spirits of any other origin, generally with industrial spirit, the mixture must be declared as "cut." Any addition of foreign flavoring substances, as essences, volatile oils or ethers, are either prohibited, or the products must be declared as *artificial.* In cases where the natural products are imitated by essences, the products of such imitations must also be declared as artificial.

THE EMPLOYMENT OF VEGETABLE PRODUCTS

As pointed out, pure spirit has no peculiar odor or taste other than those of the alcohol itself. Any particular taste desired must be imparted to the alcohol, and for this purpose vegetables, or at least products of the vegetable kingdom, as volatile oils, are used.

The commonly so-called *"cold distillation"* consists in the extraction of vegetable substances without distillation by treatment with alcohol, or by dissolving volatile oils in alcohol, which products are employed to give the spirit the peculiar simple or compound taste.

On the other hand the "*warm distillation*" is employed by really distilling vegetable substances. Which kind of distillation is to be preferred depends upon the nature of the raw materials, because many vegetable substances are to be used only because of their extractive matter, while others are valuable because of the volatile flavors they contain.

METHODS OF EXTRACTION

The extractive matters of vegetables are formed in the plant juice of the living plant, and when the plant parts are dried and employed as drugs, the extractive matters when desired must be dissolved out by a suitable medium, and as alcohol is a necessary ingredient of liquors, it is the best medium for extraction.

The solubility of the various extractive matters differs. Most of them are soluble in the cold. Of course the solubility depends upon the heat, and is increased by this factor. Cold extraction is called *maceration;* the hot extraction *digestion.*

The advantage of the digestion is the shorter time required for solution, but, on the other hand, substances soluble when hot are often precipitated out on cooling; and often unnecessary substances are obtained in solutions made with heat which were better absent, and which require subsequent removal.

For these reasons cold solution is to be preferred to prevent any later cloudiness; moreover, heat often adversely affects the fineness of some aromatic matters, and hence the cold extracts are usually the finer as to taste.

In *maceration,* which is the older method, the drugs are covered with alcohol of any desired dilution and allowed to stand for some time with frequent stirring, and are then expressed. Digestion (see Fig. 34) takes place when the drugs are warmed with the menstruum for some time at 135° F., and this is repeated once or twice on the following days; then the liquid is pressed off. In both cases the result is a tincture of more or less concentration, according to the character of the drugs and the menstruum. Usually tinctures are made from 1 part drug to 5 parts of alcoholic menstruum.

The better method is that of *percolation* (see Fig. 35), and in all formulas calling for extraction this is to be understood as effected by percolation. The method allows the exhaustion of the material to the utmost with but a minimum loss of alcohol. The concen-

tration of the percolated products can be increased, and reaches its highest extent in the *fluid extracts*, of which 1 part by weight represents 1 part by weight of the drugs treated. For essences

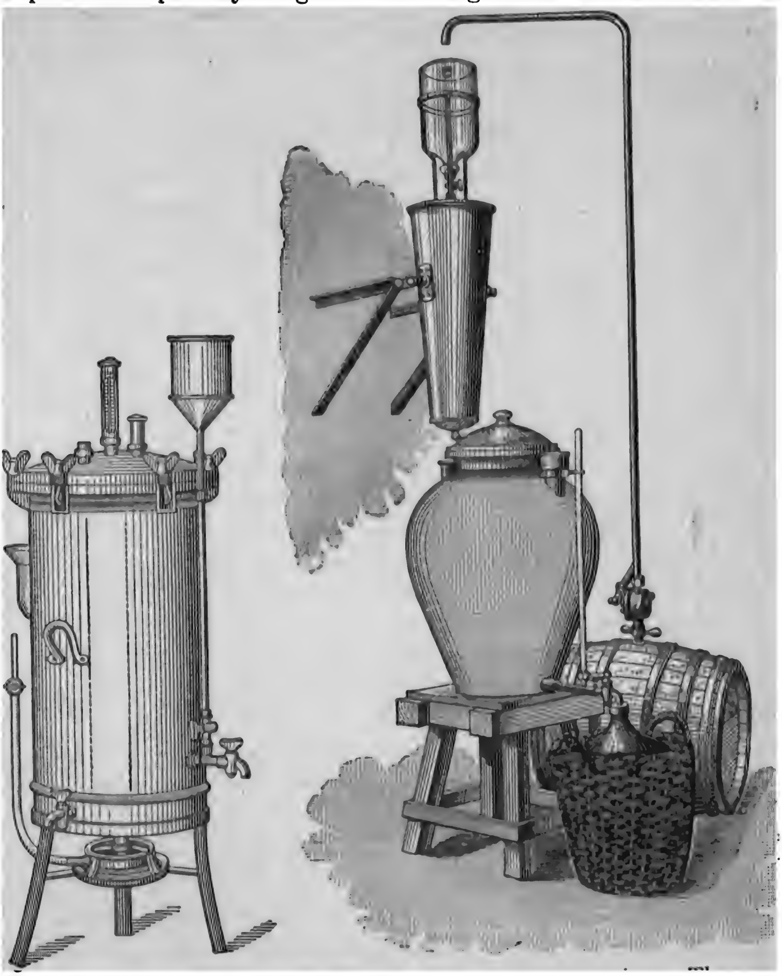


FIG. 34. Digestion apparatus.

FIG. 35. Percolator with receiver. The menstruum is forced through the materials by pressure.

this concentration is not necessary, and usually 1 part of drug made to represent 2 parts of extract or essence suffices. In this method the ground drugs are packed in a percolator and moistened

with alcohol. After three days the percolation is started, adding sufficient of the desired menstruum, and collecting the first run of percolate, which contains nearly all of the soluble substances, and which constitutes about 85% of the total amount of the expected extract. The percolation is then continued, but now using water, to obtain a secondary percolate which is then evaporated or

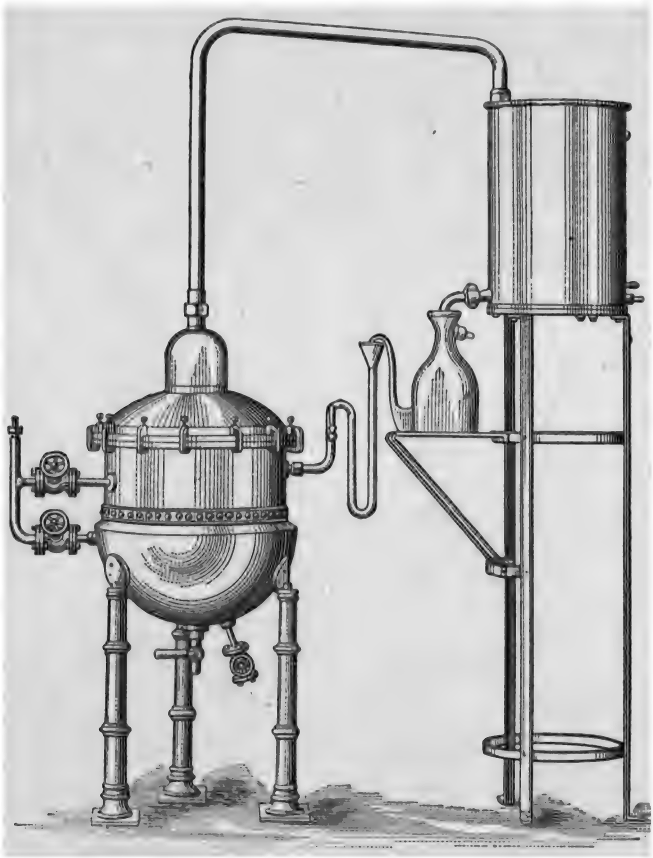


FIG. 36. Apparatus for distilling essential oils and essences.

distilled. For instance if 10 lb. drugs are percolated with, say, about 25 lb. of diluted alcohol the result will be 17 lb. first percolate and 6 lb. secondary percolate, the latter being then evaporated down to 3 lb. and mixed with the first percolate to make a total of 20 lb.

Otherwise, after receiving the 85% first percolate, the secondary percolate is placed in the still, and, after the addition of water, distilled until a residue of 15% results. In the above case 17 lb. of first percolate are obtained; the secondary percolate is then distilled with sufficient water to yield 3 lb. of residue which is then mixed with the first percolate. The extract now contains also the most of the volatile constituents of the drugs besides the soluble extractive matters.

EMPLOYMENT OF VOLATILE OILS

To transfer the volatile flavors to beverages, the simplest method would appear to be to use the isolated volatile oils of

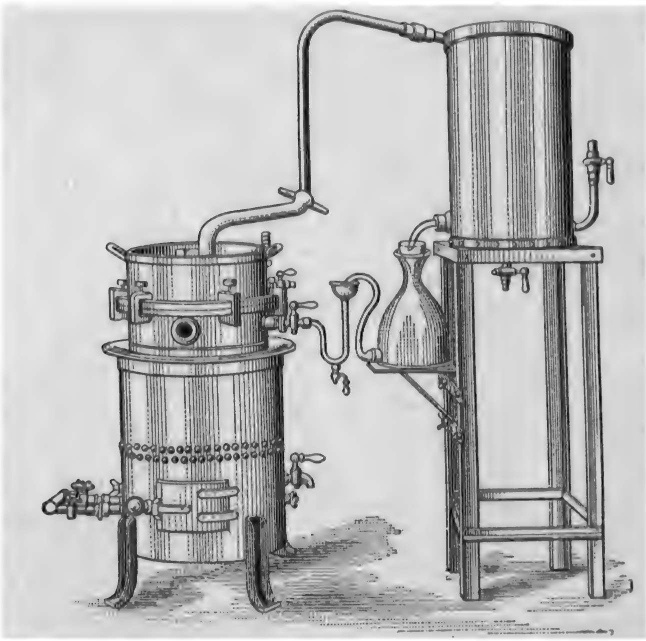


FIG. 37. Universal still with reflux cover-condenser (system Erich Walter).

commerce, which will yield the same or even better service, in many cases, than the drugs themselves. As is well known, volatile oils consist of terpenes and special carriers of the taste. The latter are relatively easily soluble in diluted alcohol, while the terpenes cause cloudiness in beverages, hence it is best to remove the terpenes. Only in some cases does simple solution of volatile

oils in alcohol suffice; the terpenes are partially separated, and collect in the form of oily drops which are filtered off. But the simple dissolving is not economical, because the terpenes are a better solvent of the flavors than is diluted alcohol. The oils are not exhausted, and therefore the distillation of volatile oils with alcohol is the most rational method. This is carried out as follows: The volatile oils, or a mixture of any of them, are distilled into a Florence flask from which they are returned to the still by a return tube, and wherein the terpenes are separated; after the layer of terpenes no longer increases, the distillation is finished. The distillate contains no more terpenes, and is perfectly soluble even in alcohol of low strength. The terpenes are worthless for flavoring.

Instead of this method, the so-called terpeneless volatile oils are also used, because of their better solubility in low-proof alcohol. On account of the difference in their concentration, their employment is quite different from that of the simple volatile oils. In some cases the isolated flavors, such as carvone from oil of caraway, and anethol from oil of anise seed, and others, are employed because of their solubility.

DISTILLATION OF DRUGS FOR SPIRITS

Even though the employment of volatile oils is more convenient and simple, the distillation of drugs gives the finer results. The volatile oils represent the proper taste of the drugs, but they are often changed by the heat of the distillation; on the other hand, if the drugs are distilled with alcohol the aromatic constituents are transferred more naturally, and therefore the so-called *vegetable distillates* are preferred as to quality of yield, as, for instance, in aromatic waters.

COMPOUNDED VOLATILE OILS (LIQUEUR OILS)

Instead of essences some customers like highly concentrated products, and in this case the compounds made from volatile oils serve well. So far as the character of the taste permits the use of this method, formulas are given for such products, but it is of course impossible so far as extractive flavors are in question. On the other hand the compounds often serve to fortify any essence or liqueur. The use is the same as that of volatile oils in general.

THE COMPOSITION OF ALCOHOLIC BEVERAGES

The most important constituent of alcoholic beverages is the alcohol. Its strength depends upon the character of the beverage. It must be understood that some flavors first predominate when the alcohol is of a certain strength. In some cases the cost of the beverage depends upon the alcohol, because the latter is the most expensive constituent. In the tables to follow are given the strengths of alcohol usually employed. Although alcohol is the leading factor, it is advisable not to be too sparing with it, because it would be to the disadvantage of the beverage.

Sugar is used to sweeten the liqueur, but in many cases sugar thickens the liqueurs, and therefore glucose is often employed, although it has less sweetening power. When sugar syrup is prescribed, the 60% solution is intended.

The *colors* mentioned are those used as a rule, but they may be varied according to custom or the individual taste. For brown color, the most predominant, burnt sugar (caramel) is used largely, as its taste is often welcome for rounding out the taste of liqueurs.

Some additions are often made so as to *refine* the taste, and for this fruit juices are often used, while arrac, rum and cognac are also employed, and the more so as essences are mostly prepared with the addition of some wine brandy. Some liqueurs are refined with wines to give them a fuller taste.

The quantity of *essences* required is given at the head of each formula.

On mixing alcohol with water a contraction in volume occurs. The composition tables, calculated for 10 gallons, require the employment of 10¼ gallons in all to afford the 10 gallons of complete beverage.

The order in which the ingredients are to be mixed is as follows: Mix first the cold sugar syrup with the water, then add the alcohol and then the essence or the volatile oils dissolved in alcohol. Last of all add the refining preparations and the color.

By some manufacturers so-called *foundation liquors* are used. Sugar syrup, water and alcohol are mixed and stored. When used, the essences and color are added to make finished liqueurs. The reason for this procedure is to age the mixture of sweetened spirit, but this is better effected by storing with the aroma added.

STORING AND AGEING LIQUORS

Every freshly prepared mixture of aromatic substances lacks homogeneousness, and only after some time are the ingredients well mixed and fully blended. Storage is necessary in every case to round out the taste and to clear the beverages. Tannin appears to possess the power of hastening such ageing and improving the taste, and hence oak casks are best adapted for liquors. Extracts of drugs containing tannic acid, as of limousin wood, are often employed with success. For dark-colored liquors, about $\frac{1}{4}$ lb. tincture of rhatany (krameria) root per gallon is to be recommended.

To clear the liquors storage is usually sufficient, but the clearing can be hastened by the addition of $\frac{1}{2}$ pint of skimmed milk. Where rapid clearing is desired filtration must be resorted to.

Remark: In the formulas, alcohol of about 38° overproof is to be understood unless otherwise stated.

SPECIAL MANUFACTURE OF ESSENCES FOR BRANDIES, LIQUEURS AND LIQUORS

I. Alcoholic Beverages with Predominant Taste of Volatile Flavors

By this is to be understood the *predominant* flavor characteristic of the volatile flavoring constituents of the volatile oils, no matter by what method incorporated into the beverage. This is sometimes done by distilling the drugs, by dissolving the volatile oils, etc. Some, in spite of the predominant volatile character of the base, are based on extractive taste, or are at least partly dependent on it. The main taste is, of course, varied in the greatest manner by the addition of other flavors, yet in all cases a predominant type of taste is recognized by which these compounds are differentiated from other harmonious compounds in which the individual constituents cannot be recognized off-hand, and in which no one flavor will be recognizably predominant.

(*a*) *Citrus Fruits*

The flavor of the so-called citrus fruits (lemon, orange, lime, mandarin, etc.) is present in the form of volatile oil in the peels exclusively. The natural flavor is obtained from fresh peels, because during drying it is largely volatilized, some being also

resinified. Besides the purely volatile flavor, some extractive matters are also present which are very bitter, and are desired in some compounds for the making of which dried peels are ordered. This is also the case with some of the following formulas, and a special method is employed with extracts from dried peels. In this case it is advisable to use the "expulped" peels, *i.e.*, peels from which the inner white parenchyma has been removed by first scalding with hot water to soften it, and then scraping with suitable knives.

Method A. — Distillates from Fresh Peels

The peels of fresh fruits are employed immediately after peeling. Of the lemons and sweet and bitter oranges, the peels of green unripe fruits are to be preferred. Mandarins are peeled only with the hands. As far as genuine Curaçao peels are concerned, they form the finest raw material for Curaçao specialties.

The following formula applies for all kinds of fresh peels: 8 lbs. fresh peels are distilled with 1½ gallons alcohol and 3 gallons water, using a Florence flask with return tube to separate the terpenes. After this, the return tube is disconnected, 2 gallons of water are added to the still and 4 gallons distilled off. This is to be filtered clear with the aid of infusorial earth, and rectified to the final result of 10 lb.

Method B. — Extract Essence from Fresh Peels

These are used where the bitter taste of the peels is desired. 8 lb. fresh peels are mixed with 2½ gallons alcohol of 20° overproof for 3 days, and then 8 lb. of extract are collected without expressing. The total remainder is then placed in a still with 4 gallons water, and ½ gallon is distilled off, which, after filtration with infusorial earth, is rectified to 2 lb. which are mixed with the extract to yield a final result of 10 lb.

Method C. — Extract Essence from Dried Peels

Only peels from which the inner white parenchyma has been removed is to be employed. 5 lb. expulped peels are treated with 2 gallons proof spirit for three days, then collect without expressing 7½ lb. extract. On the residue pour 2 gallons water, distil off ½ gallon, filter this distillate with the aid of infusorial earth and rectify it to 2½ lb., which then mix with the extract to yield the total result of 10 lb.

1. Barbadoes Liqueur Essence

(2 oz. per gallon)

Extract Essence from Drugs

Cloves	½	lb.
Cardamon	½	"
Mace	¾	"
Expulped Lemon Peels	2	"
" Sweet Orange Peels	2	"

Method C. Final result 10 lb.

2. Bergamot Essence

(1 oz. per gallon)

From Volatile Oils by Distillation

Oil of Neroli	1	dr.
Oil of Lemon	1½	oz.
Oil of Bergamot	4	"

These oils are distilled, using the return tube, with

Alcohol	½	gal.
Water	1	"

for one hour, and collecting ¾ gal. distillate, to which ¼ gallon water is added; this is then filtered clear with infusorial earth, and rectified after adding 1 pint genuine wine distillate to the amount of 9½ lb.; then add

Vanillin	⅛	dr.
Amyl Acetate	8	"
Alcohol	7½	oz.

Final result 10 lb.

3. Bishop-Liqueur Essence

(5 oz. per gallon)

Extract Essence from Fresh Peels

Mace	¼	oz.
Cardamon	¼	"
Cloves	2½	"
Cinnamon Bark	4	"
Bitter Orange Fruits	½	lb.
Fresh Sweet Orange Peels	3	"
Fresh Green Bitter Orange Peels	4	"

Method B. Final result 10 lb.

4. Curaçao Essence, Dutch

(5 oz. per gallon)

Extract Essence from Fresh Peels

Cloves	3	oz.
Cinnamon Bark	5	"
Fresh Sweet Orange Peels	3½	lb.
" Curaçao Peels (or else bitter orange peel)	4	"

Method B. Final result 10 lb.

5. Curaçao Essence, French

(2 oz. per gallon)

Extract Essence from Drugs

Cinnamon Bark	2	oz.
Cloves	2	"
Calamus Root	4	"
Ginger	4	"
Bitter Orange Fruits	½	lb.
Sweet Orange Peel, Expulped	1	"
Curaçao Peels, Expulped	2¾	"

Method C. Final result 10 lb.

6. Lemon Liqueur Essence

(5 oz. per gallon)

Sweet Orange Distillate, Method A	2 lb.
Lemon Extract Essence, Method B	3 "
Lemon Distillate, Method A	5 "
	10 lb.

7. Spiced Lemon Liqueur Essence

(5 oz. per gallon)

Oil of Coriander	¼	dr.
Oil of Mace	1¼	oz.

Dissolve in

Alcohol	14¾	"

then add

Orange Flower Water	1	lb.
Lemon Liquor Essence from fresh peels	8	"
	10	lb.

8. Bitter Orange Liqueur Essence

(5 oz. per gallon)

From Fresh Peels

Lemon Distillate, Method A	2 lb.
Bitter Orange Extract Essence, Method B	3 "
Bitter Orange Distillate, Method A	5 "
	10 lb.

9. Bitter Orange Essence

(2 oz. per gallon)

Extract Essence from Drugs

Bitter Orange Fruits	½ lb.
Sweet Orange Peels	2 "
Bitter Orange Peels, Green	3 "

Method C. Final result 10 lb.

10. Sweet Orange Essence

(5 oz. per gallon)

Orange Flower Water	1 lb.
Lemon Distillate, Method A	1 "
Sweet Orange Extract, Method B	2 "
Sweet Orange Distillate, Method A	6 "
	10 lb.

11. Mandarin Liqueur Essence

(5 oz. per gallon)

From Fresh Fruit Peels

Mandarin Extract Essence, Method B	1 lb.
Mandarin Distillate, Method A	3 "
Sweet Orange Distillate, Method A	5 "
	10 lb.

Compounded Volatile Oils for Beverages with the Taste of Citrus Fruits.

Employment: 1 oz. is sufficient for 1 lb. essence, whereof 1 oz. is required to flavor a gallon of the beverage.

12. Compounded Oil for Bergamot Liqueur

Oil of Neroli	½ dr.
Oil of Lemon, Terpeneless	3½ "
Amyl Acetate	¾ oz.
Absolute Alcohol	1 "
Oil of Bergamot	14 "
	1 lb.

13. Compounded Liqueur Oil for Curaçao Liqueur, Dutch

Oil of Lemon, Terpeneless	½ dr.
" " Sweet Orange, "	½ "
" " Coriander	3½ "
" " Sweet Orange, "	6 "
" " Ginger	7 "
" " Cinnamon	14½ "
" " Calamus	1 oz.
Absolute Alcohol	13 "
	1 lb.

14. Compounded Liqueur Oil for Curaçao Liqueur, French

Oil of Neroli	1/16 dr.
" " Sweet Orange, Terpeneless	3/16 "
Oil of Lemon, Terpeneless	3 "
" " Coriander	3¾ "
" " Bitter Orange, Terpeneless	6 "
Oil of Calamus	11 "
" " Cinnamon	1 oz.
" " Cloves	1 "
Absolute Alcohol	12½ "
	1 lb.

15. Compounded Liqueur Oil for Lemon Liqueur

Oil of Sweet Orange, Terpeneless	1 dr.
Oil of Lemon, Terpeneless	11 "
Absolute Alcohol	15½ oz.
	1 lb.

16. Compounded Liqueur Oil for Spiced Lemon Liqueur

Oil of Neroli	⅛ dr.
" " Sweet Orange, Terpeneless	⅞ "
Oil of Coriander	5 "
" " Mace	9 "
" " Lemon, Terpeneless	9 "
Absolute Alcohol	14½ oz.
	1 lb.

17. Compounded Liqueur Oil for Bitter Orange Liqueur

Oil of Lemon, Terpeneless	1½ dr.
" " Bergamot	2½ "
" " Bitter Orange, Terpeneless	4 "
Absolute Alcohol	15½ oz.
	1 lb.

18. Compounded Liqueur Oil for Sweet Orange Liqueur

Oil of Lemon, Terpeneless	1½ dr.
" " Sweet Orange, Terpeneless	6½ "
Absolute Alcohol	15½ oz.
	1 lb.

19. Compounded Liqueur Oil for Mandarin Liqueur

Oil of Sweet Orange, Terpeneless	⅞ dr.
Oil of Lemon, Terpeneless	1⅛ "
" " Tangerine Terpeneless	6 "
Absolute Alcohol	15½ oz.
	1 lb.

(*b*) *Weakly Spiced Liqueurs.* (*Anise, Fennel, Caraway, Juniper and Peppermint*)

Beverages with the taste of these spices never contain extractive aromatics, and their taste is due solely to volatile oils. However, it is advisable to distil the drugs themselves with alcohol to obtain essences having a more pronounced and pure taste than is afforded by volatile oils alone. For this purpose so-called vegetable distillates are used, which in general are manufactured by the following Method 1.

For example let us take a vegetable distillate of anise seed. The weight of the drugs varies according to their spice content, but the quantity of the alcohol taken is always the same, and so is also the final result.

Method 1 *for Vegetable Distillates*

(*Example:* Anise Distillate, 5 oz. per gallon.)

Anise Seed, crushed	40 lb.
Alcohol, 17° underproof	15 gal.

Distil for about 1 to 1½ hours, using a return tube with a Florence flask, wherein the greater part of the terpenes are collected, while the alcoholic distillate returns to the still. After the time mentioned, the distillation is interrupted and the Florence flask, with the terpenes obtained as a by-product, is removed.

Now add about 10 gallons water to the still, distil off 15 gallons and filter the distillate with the aid of infusorial earth, because it will be cloudy, due to some terpenes or sesquiterpenes not completely removed; then rectify the clear filtrate to the final result of 10 gallons. This essence will not cloud alcoholic liquids, even though of very low alcohol content.

This distillate is used for liqueurs in the proportion of 5 oz. to a gallon.

Another method for making essences by means of volatile oils only is by distilling them according to the following Method 2. This will give better service than the simple solution of volatile oils in alcohol, because the terpenes are removed by this method and the taste will be finer. Such essences will not cloud beverages with a low alcohol content. The following example also applies to essence of anise. The volatile oils will vary according to the different flavors, but the quantity of alcohol necessary is always the same. After the distillation is finished some alcohol is added to prevent any subsequent clouding.

Method 2 for Essence from Volatile Oils

(*Example:* Anise Essence, 1 oz. per gallon.)

Oil of Lemon	1 oz.
" " Anise Seed (as Anethol)	7 "

Distil with return tube and Florence flask with

Alcohol	½ gal.
Water	1 gal.

The terpenes collecting in the Florence flask are removed after about one hour, after which there is distilled off ¾ gallon distillate, which is diluted with ¼ gallon water and filtered with the aid of infusorial earth to remove the residual cloudiness.

Wine Distillate	1 pint

is now added for refining purposes, and the whole rectified to yield 9½ lb. to which further add

Alcohol	½ lb.

to prevent further clouding. Final result 10 lb.

Remarks: In the case of anise alone it is unnecessary to cool below 77° F., because anethol solidifies at a lower temperature.

The essences from essential oils are generally used in the proportion of 1 oz. to the gallon.

Anise Liqueurs

20. Anise Essence

Vegetable Distillate (5 oz. per gallon)
See above Method 1.

21. Anise Essence

From Volatile Oils (1 oz. per gallon)
See above Method 2.

22. Anisette Essence, Dutch

From Volatile Oils (1 oz. per gallon)

Oil of Cardamom	1⅛ dr.
" " Cinnamon	2⅛ "
" " Caraway	3⅛ "
" " Cloves	3⅛ "
" " Lemon	9 "
" " Fennel	13 "
" " Star Anise	4 oz.

By Method 2. Rectify to 9½ lb., then add

Vanillin	⅛ dr
Orris Root Tincture	1 oz.
Raspberry Spirit	1 "
Alcohol	6 "

Final result 10 lb.

23. Anisette Essence, French

From Volatile Oils (1 oz. per gallon)

Oil of Cardamom	¼ dr.
" " Sweet Orange	1¼ "
" " Lemon	1¼ "
" " Ginger	2 "
" " Coriander	3⅛ "
" " Calamus	5⅛ "
" " Cloves	9 "
" " Cinnamon	9 "
" " Star Anise	5½ oz.

By Method 2.

Rectify to 9½ lb., then add

Ethyl Acetate	½ oz.
Orris Root Tincture	2 "
Pineapple Fruit Essence	2 "
Alcohol	3½ "

Final result 10 lb.

24. Fennel Essence

Vegetable Distillate (5 oz. per gallon)
By Method 1.

Coriander Seed	4 lb.
Anise Seed	8 "
Fennel Seed	48 "

Final result 10 gal.

25. Rostopschin Essence, Austrian Specialty

From Volatile Oils (1 oz. per gallon)

Oil of Coriander	8½ dr.
" " Lemon	8½ "
" " Cinnamon	1 oz.
" " Cloves	1½ "
" " Sweet Orange	1½ "
" " Star Anise	3 "

By Method 2. Rectify to 9½ lb., then add

Vanillin	¾ dr.
Ethyl Acetate	1 oz.
Orris Root Tincture	3 "
Alcohol	4 "

Final result 10 lb.

26. Star Anise (Badiane) Essence

Vegetable Distillate (5 oz. per gallon)

From 48 lb. Star Anise Seed by Method 1 to make 10 gal.

Compounded Liqueur Oils for Anise Cordials

Employment: 1 oz. is sufficient for 1 lb. of essence, whereof 1 oz. is required to flavor a gallon of beverage.

27. Compounded Liqueur Oil for Anisette, Dutch

Oil of Lemon, Terpeneless	¼ dr.
" " Cardamom	3½ "
" " Cinnamon	6¼ "
" " Cloves	9 "
" " Caraway	9 "
" " Fennel	1¼ oz.
" " Star Anise	13 "
	1 lb.

28. Compounded Liqueur Oil for Anisette, French

Oil of Lemon, Terpeneless.	⅜ dr.
" " Sweet Oranges, Terpeneless	⅜ "
" " Cardamom	2¼ "
" " Ginger	4 "
" " Coriander	7 "
" " Calamus	10 "
" " Cinnamon	1¼ oz.
" " Cloves	1¼ "
" " Star Anise	12 "
	1 lb.

29. Compounded Liqueur Oil for Rostopschin

Oil of Lemon, Terpeneless	2 dr.
" " Sweet Orange, Terpeneless	6 "
" " Coriander	1¼ oz.
" " Cinnamon	2¼ "
" " Cloves	2¼ "
" " Star Anise	9¾ "
	1 lb.

Caraway Beverages

30. Caraway Essence

Vegetable Distillate (5 oz. per gallon)

From 64 lb. Caraway Seed by Method 1 to yield 10 gal.

31. Caraway Essence

From Volatile Oils (1 oz. per gallon)

Oil of Lemon	3½ oz.
" " Caraway	12 "

By Method 2. Rectify to 9½ lb., and add ½ lb. alcohol to complete 10 lb. result.

32. Double Caraway Essence (Caraway Cordial, Breslau or Berlin Type)

From Volatile Oils (½ oz. per gallon)

Oil of Fennel	7 dr.
" " Star Anise	1¼ oz.
" " Lemon	1¼ "
" " Caraway	1 lb.

By Method 2. Rectify to 9½ lb., and add alcohol to make a final result of 10 lb.

Remark: For Caraway Brandy use instead of alcohol and water 1½ gal. grain alcohol of 17° underproof.

33. Russian Caraway Essence — Allasch

From Volatile Oils

(1 oz. per gallon)

Oil of Rose	¼ dr.
" " Coriander	4 "
" " Peppermint	4 "
" " Fennel	9 "
" " Lemon	9 "
" " Caraway	9 oz.

By Method 2. Add 1 pint Wine Distillate before rectifying to 9½ lb., then add

Ethyl Acetate	½ oz.
Alcohol	7½ "

Final result 10 lb.

34. Compounded Liqueur Oil for Caraway Cordial

Oil of Lemon	¼ oz.
" " Bitter Orange	¼ "
" " Fennel	¾ "
" " Carvon	14¾ "
	1 lb.

35. Compounded Liqueur Oil for Double Caraway Cordial

Oil of Lemon	½ oz.
" " Fennel	1 "
" " Star Anise	3½ "
Carvol	11 "
	1 lb.

36. Compounded Liqueur Oil for Russian Caraway — Allasch

Oil of Coriander	½ oz.
" " Cloves	½ "
" " Cinnamon	½ "
" " Anethol	1 "
Carvol	13½ "
	1 lb.

Compounded Liqueur Oils for Caraway Beverages

Employment: 1 oz. for 1 lb. of essence, whereof 1 oz. per gallon is required.

Instead of oil of caraway, the more concentrated carvon (carvol) may be used.

37. Crystallized Caraway Liqueur, Called Ice Caraway

This liqueur is nothing else than a physical play due to the inability of sugar to remain in solution in strongly alcoholic liquids, but to crystallize.

Boil 50 lb. hard crystallized sugar with 2 gallons water to a syrup, filter through flannel, and while still hot add 6 gallons strong alcohol and 10 oz. Russian Caraway Essence. Filter hot, and as quickly as possible, and fill into white glass bottles to three-fourths of their content. The bottles are stoppered, and placed in a vat filled with crushed ice mixed with some table salt. While cooling the sugar crystallizes slowly; and the more slowly the more beautiful are the crystals. The bottles are finally filled completely with any desired caraway liqueur of high alcohol content.

Juniper Beverages

When juniper berries are fermented they afford a liquor having a pleasant taste of the berries. The liquor may also be obtained by distilling the berries with alcohol or corn whisky. Many beverages original in several countries contain more or less juniper, such as gin and geneva, Machandel and as a German specialty "Steinhaeger." Sometimes the juniper liquors are prepared with grain alcohol to alter their taste.

38. Juniper Essence
Vegetable Distillate
(5 oz. per gallon)

Juniper Berries	96 lb.

Distil by Method 1 to the final result of 10 gal.

39 Juniper Essence
From Volatile Oils
(1 oz. per gallon)

Oil of Lemon	3 oz.
" " Juniper Berries	12 "

Distil by Method 2 to 9½ lb.

Rectify, and complete with ½ lb. grain brandy to the final result of 10 lb.

40. Geneva Essence, Dutch
From Volatile Oils
(1 oz. per gallon)

Oil of Cognac	3½	dr.
" " Wormwood	3½	"
" " Cardamom	3½	"
" " Mace	1	oz.
" " Cloves	1	"
" " Lemon	3	"
" " Juniper	12	"

Distil by Method 2 but take instead of alcohol and water 1½ gal. alcohol of 17° underproof. Rectify to 9½ lb. and add

Pineapple Fruit Essence	2	oz.
Alcohol	6	"

Final result 10 lb.

41. Gin Essence, Irish (Old Tom Type)
From Volatile Oils
(1 oz. per gallon)

Oil of Hop Flowers	⅜	dr.
" " Wormwood	7	"
Oil of Petitgrain	7	dr.
" " Cinnamon	7	"
" " Ginger	1	oz.
" " Angelica	1	"
" " Coriander	1½	"
" " Lemon	2¼	"
" " Juniper	8	"

Distil just as with Geneva Essence with alcohol to yield 9½ lb., and add

Ethyl Acetate	1	oz.
Alcohol	7	"
Vanillin	¼	dr.

Result 10 lb.

42. Steinhaeger Essence

Steinhaeger is so called after the town so-named in Westphalia.

Vegetable Distillate.
(5 oz. per gallon.)

Caraway Seed	2	lb.
Angelica Root	4	"
Juniper Berries	90	"

Distil by Method 1, but with alcohol to the result of 10 gal.

Compounded Liquor Oils for Juniper Liqueurs

Employment: 1 oz. is sufficient for 1 lb. of essence, whereof 1 oz. is required to flavor 1 gallon of the beverage.

43. Compounded Geneva Liqueur Oil

Oil of Lemon, Terpeneless	¼	dr.
" " Cognac	6¾	"
" " Wormwood	7	"
" " Cardamom	10	"
" " Juniper, Terpeneless	1	oz.
" " Mace	2	"
" " Cloves	2½	"
Absolute Alcohol	9	"
	1	lb.

44. Compounded Liqueur Oil for Juniper Brandy

Oil of Lemon, Terpeneless	¼	oz.
" " Juniper, Terpeneless	1	"
Absolute Alcohol	14¾	"
	1	lb.

45. Compounded Liqueur Oil for Artificial Steinhaeger

Carvol	¼	oz.
Oil of Angelica	1	"
" " Juniper, Terpeneless	1	"
Absolute Alcohol	13¾	"
	1	lb.

Mint Beverages

Mint essences are always manufactured from volatile oils alone, because for distillation only the fresh herb could be used.

46. Balm Mint Essence

(1 oz. per gallon)

Oil of Neroli	⅛ dr.
" " Balm Leaves	5 "
" " Peppermint, Mitcham	12 "
Oil of Balm Mint	2¼ oz.

Distil by Method 2 to 9½ lb., and add

Vanillin	3½ dr.
Pineapple Fruit Essence	3 oz.
Alcohol	5 "

Final result 10 lb.

47. Peppermint Essence

(1 oz. per gallon)

Oil of Peppermint, Mitcham	3½ oz.

Distil by Method 2 to 9½ lb., and add

Wine Distillate	½ lb.

Final result 10 lb.

48. Double Peppermint Essence

(½ oz. per gallon)

Oil of Lemon	6 dr.
" " Balm Leaves	6 "
Anethol	10 "
Oil of Peppermint, Mitcham	3½ oz.

Distil just as with peppermint essence to a final result of 10 lb.

Compounded Liquor Oils for Peppermint Beverages

Employment: 1 oz. is sufficient for 1 lb. of essence, whereof 1 oz. is required for 1 gallon of beverage.

49. Compounded Liqueur Oil for Balm Mint Liqueur

Oil of Neroli	⅛ oz.
" " Balm Leaves	⅝ "
" " Peppermint, Mitcham	1¼ "
Oil of Balm Mint	6 "
Absolute Alcohol	8 "
	1 lb.

50. Compounded Liqueur Oil for Peppermint Liqueur

Oil of Lemon	¾ oz.
" " Balm Leaves	¾ "
Anethol	1½ "
Oil of Peppermint, Mitcham	6 "
Absolute Alcohol	7 "
	1 lb.

(c) *Stronger Spices partly with Extract Flavor*

(Wormwood, Calamus, Celery, Cinnamon, Cloves, Ginger, Spice and Vanilla)

These spices afford extractive aromas, although in some cases the volatile flavors, as volatile oil, are used alone. Frequently, however, the volatile flavor is not strong enough, as ginger and calamus, where the general taste is not a volatile one but sharp or

aromatic bitter. Vanilla contains no volatile flavor but a specific aromatic, vanillin, as flavor, and is used only by extraction, or by substitution with vanillin.

Absinthe (Wormwood)

Absinthium, wormwood, is a bitter herb, and is much used as a stomachic. It is often employed by itself because of its combined aromatic and bitter taste. It is said the absinthe liqueurs are injurious to man, especially when habitually drunk. Most of the countries where absinthe is taken as a national drink have prohibited it, and therefore it has lost its original importance.

51. Absinthe, Swiss

(As complete drink)

To be taken diluted with 4 to 5 parts water as an opalescent liqueur.

Angelica Seed	½ lb.
Coriander Seed	1 "
Wormwood, Alpine, Flowering Tops	3 "
Fennel Seed	3 "
Anise Seed	8 "

Macerate for two days in a still with

Alcohol	5 gal.
Water	3½ "

After two days distil off, then add

Water	5 gal.

and distil to yield 10 gal. finished product.

52. Absinthe Essence, French

(2 oz. per gallon)

Coriander	2 oz.
Cinchona Bark	3 "
Anise Seed	3 "
Calamus Root	½ "
Centaury Herb	½ "
Valerian Root	½ "
Wormwood, Alpine, Flowering Tops	8 "

Percolate with

Alcohol	10 lb.
Wine Distillate	3 "
Water	12 "

After 3 days collect first percolate of 15 lb., then pour on sufficient water to obtain about 10 lb. after-percolate, which rectify to 5 lb., which, mixed with the first percolate, give 20 lb. final result.

53. Absinthe Essence, German

(2 oz. per gallon.)

Cinnamon Bark	2 oz.
Star Anise Seed	6 "
Ginger	6 "
Angelica Seed	6 "
Calamus Root	6 "
Lemon Peel	10 "
Anise Seed	1 lb. 2 oz.
Coriander Seed	1 " 4 "
Wormwood Herb	5 " 6 "

The same method and result as the Absinthe Essence, French, preceding.

54. Hyssop Essence

(2 oz. per gallon)

Hyssop resembles Absinthium in regards to its bitter aromatic taste.

Star Anise Seed	½ lb.
Calamus Root	½ "
Angelica Root	½ "
Centaury Herb	1 "
Gentiana Root	1 "
Wormwood Herb	2 "
Hyssop Leaves	5 "

Use the same method as for French Absinthe Essence.

Compounded Liqueur Oils for Absinthes

Employment: 1 oz. is sufficient for 1 lb. essence, whereof 1 oz. is required for a gallon of beverage.

55. Compounded Liqueur Oil for French Absinthe Liqueur

Oil of Coriander	9 dr.	
" " Cloves	9 "	
" " Cassia Cinnamon	9 "	
Oil of Fennel	1 oz.	
" " Star Anise	2 "	5 dr.
" " Wormwood	11 "	
	1 lb.	

56. Compounded Liqueur Oil for German Absinthe Liqueur

Oil of Angelica	1 oz.
" " Lemon	1 "
" " Sweet Orange	1 "
" " Calamus	2 "
" " Coriander	2¾ "
" " Wormwood	8¼ "
	1 lb.

57. Compounded Liqueur Oil for Swiss Absinthe

Oil of Angelica	6 dr.
" " Anise	10 "
" " Fennel	1 oz.
" " Coriander	5 "
" " Wormwood, French	9 "
	1 lb.

Calamus (Sweet Flag)

The taste of calamus root depends upon a volatile flavor, but it is assisted by an aromatic bitter substance contained in the bark of the root. It is, therefore, necessary to use the unpeeled root. The best result is obtained with the fresh root, the flavor of which is most powerful in the early summer season, at the beginning of June.

58. Calamus Essence

Vegetable Distillate from Fresh Root

(5 oz. per gallon)

80 lb. fresh Calamus root are distilled by Method 1 to the final result of 10 gal.

59. Calamus Essence

From Volatile Oils

(1 oz. per gallon)

Oil of Calamus .... ½ lb.

is employed, using Method 2, to afford 9½ lb. rectificate. Then add

Ginger Essence	3 oz.
Alcohol	5 "

Final result 10 lb.

60. Compounded Calamus Essence (Calmuser Liqueur)

From Volatile Oils

(1 oz. per gallon)

Oil of Angelica	½ oz.
" " Cardamom	½ "
" " Cinnamon	1 "
" " Calamus	14 "

Distil by Method 2 to 9½ lb., rectificate, and add

Vanillin	3 dr.
Acetic Ether	2 oz.
Alcohol	6 "

Final result 10 lb.

61. COMPOUNDED LIQUEUR OIL FOR CALAMUS LIQUEUR

Usual Employment of Compounded Oils

Oil of Angelica	½ oz.
" " Ginger	2 "
" " Calamus	13½ "
	1 lb.

CELERY

The finest flavor is contained in the fresh celery root, but it is not pronounced enough, and it is therefore usually supplemented by that of celery seed.

62. CELERY ESSENCE

Vegetable Distillate (5 oz. per gallon)

Fresh Celery Root	5 lb.
Celery Seed, Crushed	5 "

Distil by Method 1 to a final result of 10 gal.

63. CELERY ESSENCE

From Volatile Oils (1 oz. per gallon)

Oil of Calamus	6 dr.
" " Anise Seed	10 "
" " Coriander	1¼ oz.
" " Caraway	1¼ "
" " Celery Seed	10 "

Distil by Method 2 to 9½ lb. rectificate, and add

Wine Distillate	½ lb.

Final result 10 lb.

64. COMPOUNDED LIQUEUR OIL FOR CELERY LIQUEUR

Usual Employment of Compounded Oils

Oil of Calamus	¾ oz.
" " Anise	1¼ "
" " Coriander	2¼ "
" " Caraway	2½ "
" " Celery	9¼ "
	10 lb.

CINNAMON

65. CINNAMON ESSENCE

(2 oz. per gallon)

Cinnamon Flowers	½ lb.
Cinnamon Bark, Ceylon	1½ "
Cinnamon Cassia	3 "

Percolate with

Wine Distillate	1 lb.
Orange Flower Water	1 "
Water	4 "
Alcohol	5 "

Collect first percolate of 9 lb., then add water, and collect 5 lb. after-percolate, which then rectify to 1 lb., which add to the first percolate to the final result of 10 lb.

66. CINNAMON ESSENCE, WHITE

From Volatile Oils (1 oz. per gallon)

Oil of Neroli	1½ dr.
" " Cinnamon	1¾ oz.
" " Cloves	1¾ "
" " Cassia	11 "

Distil by Method 2 to obtain 9½ lb. with the addition of 1 pint of Wine Distillate, and then add ½ lb. orange flower water to yield 10 lb.

67. Cinnamon Flower Essence

(2 oz. per gallon)

Cassia Cinnamon Bark	½ lb.
Ceylon Cinnamon Bark	1½ "
Cinnamon Flowers	3 "

Use the same method as for Cinnamon Essence, as preceding.

68. Compounded Liqueur Oil for Cinnamon Liqueur

Usual Employment of Compounded Liqueur Oils

Oil of Neroli	½ dr.
" " Cardamom	7½ "
" " Cloves	3½ "
" " Cinnamon, Ceylon	3½ "
" " Cassia	8½ "
	1 lb.

Cloves

69. Clove Essence

(1 oz. per gallon)

Cloves, Crushed	5 lb.

Percolate with

Alcohol	6 lb.
Water	6 "
Wine Distillate	1 "

First percolate 9 lb., and by adding water obtain 4 lb. afterpercolate which rectify to 1 lb., which add to the first percolate to yield 10 lb.

70. Rosoglio Liqueur Essence (Italian Clove Liqueur)

From Volatile Oils (1 oz. per gallon)

Oil of Cloves	7 dr.
" " Cassia	1¾ oz.
" " Cloves	1½ lb.

By Method 2 distil to obtain 9½ lb., and add

Wine Distillate	1 lb.

Final result 10 lb.

71. Compounded Liqueur Oil for Rosoglio Liqueur

Usual Employment for Compounded Liqueur Oils

Oil of Rose	½ dr.		
" " Neroli	1½ "		
" " Cinnamon	2	oz.	6 dr.
Benzaldehyde	2	"	8 "
Oil of Angelica	2	"	8 "
" " Cloves	8	"	8 "
	1 lb.		

Ginger

The best sort of ginger to use is the Jamaica. The flavor is due to a pungent substance, and is only slightly assisted by a volatile oil. Essences exclusively made of oil of ginger are aromatic, but not sharp, and therefore little liked. The root also contains some resinous substances not soluble in the low-grade alcohol employed, and which are not washed out by alkalies, as in the following method for Ginger Essence.

72. Ginger Essence from Root

(2 oz. per gallon)

10 lb. crushed ginger root are macerated with 10 lb. water in which 2½ lb. sodium bicarbonate are dissolved. Let stand for

a day, then reject the worthless extractive liquid and wash the root with cold water several times until the water running off is colorless and tasteless. The root, after draining, is then treated with

Alcohol	5 lb.
Water	6 "
Wine Distillate	1 "

for three days, and then percolated to yield 9 lb. first percolate. The afterpercolate, obtained by aid of more water, is distilled off to yield 1 lb., which is then added to the first percolate to yield 10 lb. essence.

73. Ginger Essence, Colorless

From Volatile Oils (2 oz. per gallon)

Oil of Cloves	¼ oz.
" " Cinnamon	½ "
" " Ginger	13 "

Distil by Method 2 to obtain 9½ lb., then add

Ethyl Acetate	2 oz.
Alcohol	6 "

Final result 10 lb.

74. Stomachic Ginger Essence

(2 oz. per gallon)

Cinnamon Bark	1½ oz.
Cardamom	1½ "
Coriander	3 "
Carob	12 "
Ginger Root	9 lb

Macerate with

Wine Distillate	3 lb.
Alcohol	12 "
Water	12 "

First percolate 9 lb. The afterpercolate of 5 lb. is rectified to 1 lb. which is added to the first percolate to yield a final result of 10 lb.

75. Compounded Liqueur Oil for Ginger Liqueur

Usual Employment of Compounded Liqueur Oils

Oil of Cloves	½ oz.
" " Cinnamon	1 "
" " Ginger	14½ "
	1 lb.

Compound Spice Liqueur

76. Compounded Liqueur Oil for Spice Liqueur

Usual Employment of Compounded Liqueur Oils

Oil of Coriander	¾ oz.
" " Lemon	¾ "
" " Sweet Orange	¾ "
" " Ginger	1¼ "
" " Calamus	4 "
" " Cloves	4 "
" " Cassia	4½ "
	1 lb.

Vanilla

The flavoring of vanilla beans is vanillin. For the better kinds of essences it is preferable to use the genuine extract of vanilla beans, but because of the high price of the latter, vanillin tinctures are often employed instead.

77. Vanilla Essence, Genuine
(2 oz. per gallon)

Vanilla Beans	2½ lb.
Cinnamon Bark	½ "
Percolate with	
Wine Distillate	1 lb.
Raisin Tincture	1½ "
Alcohol	4½ "
Water	5½ "
Rose Water	½ "

Result, without collecting any after-percolate, 10 lb.

78. Vanillin Essence
(½ oz. per gallon)

Vanillin	¾ oz.
Wine Distillate	2¼ "
Water	3½ "
Alcohol	9½ "
	1 lb.

Composition of Liqueurs with the Predominant Flavor
For 10 gallons

Essence formula No.	Liqueurs.	Content of alcohol, degrees under-proof.	Quantity of essence.	Alcohol 38° over-proof.	Sugar syrup, 60%.	Water.	Color and other additions.
	Citrus Liqueurs		Oz.	Gal.	Gal.		
1	Barbadoes Liqueur	21	20	3½	4	2¾	brown-red
2 & 12*	Bergamot Liqueur	19	10	3¾	2½	4	yellowish-green
3	Bishop Liqueur	19	50	3½	3	3¾	brown
4	Curaçao, Dutch	19	50	3½	2½	4¼	orange
13*	" "	19	10	3¾	2½	4	"
5	" French	19	20	4	2½	3¾	"
14*	" "	19	10	4¼	2½	3½	"
6	Lemon Liqueur	21	50	3½	2	4¾	yellow
15*	" "	21	10	3¾	2	4½	"
7	Spiced Lemon Liqueur	21	50	3½	2½	4¼	"
16*	" " "	21	10	3¾	2½	4	"
8	Orange, Bitter	21	50	3½	2½	4¼	orange
17*	" "	21	10	3¾	2½	4	"
9	" "	19	20	3¾	2	4½	brown
10	Orange, sweet	21	50	3½	2½	4¼	orange
18*	" "	21	10	3¾	2½	4	"
11	Mandarin Liqueur	21	50	3½	3	3¾	"
19*	" "	21	10	3¾	3	3½	"
	Anise Liqueurs						
20	Anise Brandy	22	50	3¼	.....	6½	colorless
21*	Anise Liqueur	19	10	4	¼	6	"
22 & 27*	Anisette, Dutch	19	10	4	2½	3¾	"
23 & 28*	" French	19	10	4	2½	3¾	"
24	Fennel, Bitter	22	50	3¼	.....	7	"
25 & 29*	Rostopschin	19	10	4	2¾	3½	"
26	Star Anise Liqueur	19	50	3¼	.....	7	"

* *Remark:* This is to be understood as essence made from compounded liqueur oils.

COMPOSITION OF LIQUEURS WITH THE PREDOMINANT FLAVOR.
— *Continued*

Essence formula No.	Liqueurs.	Content of alcohol, degrees under-proof.	Quantity of essence.	Alcohol 38° over-proof.	Sugar syrup, 60%.	Water.	Color and other additions.
	Caraway Liqueurs		Oz.	Gal.	Gal.		
30	Caraway Brandy...........	27	50	2¾	½	7	colorless
31 & 34*	" Liqueur...........	27	10	3	1	6¼	"
32 & 35*	Double Caraway Liqueur...	19	5	4	2	4¼	"
33 & 36*	Russian Caraway Allasch...	19	10	4	2½	3¾	"
	Juniper Liquors						
40 & 43*	Genever, Dutch.............	15	10	4	1	5¼	colorless
41	Gin, Irish....................	15	10	4¼	¼	5¾	"
39 & 44*	Juniper Brandy..............	19	10	4	¼	6	"
38	" "	22	50	3½	.....	6½	½ gal. alcohol
42	Steinhaeger.................	19	50	4¼	.....	4½	1½ gal. alcohol
45*	"	19	10	4½	.....	4¼	1½ gal. alcohol
	Mint Liqueurs						
46 & 49*	Balm Mint Liqueur.........	19	10	4	2½	3¾	light-green
47	Peppermint Liqueur.........	24	10	3½	2	4¾	green or colorless
48 & 50*	" Cream..........	19	10	4	2½	3¾	green or colorless
	Absinthe Liqueurs						
52 & 55*	Absinthe, French...........	19	10	4	1	5¼	green
53 & 56*	" German..........	19	10	4	.....	6½	"
57*	" Swiss	12	10	4¾	.....	5½	light-green
54	Hyssop Liqueur.............	19	20	4	1½	4¾	brown
58	Calamus Liqueur	23	50	3¼	2½	4½	brown
59 & 61*	" "	23	10	3½	2½	4¼	colorless
60	Calmuser Liqueur...........	23	10	3½	1½	5¼	brown
62 & 64*	Celery Liqueur..............	17	10	3	2	5¼	colorless
65	Cinnamon Liqueur	24	20	3¼	2½	4½	brown
66 & 68*	" "	29	10	3	3½	3¾	colorless
67	Cinnamon Flowers Liqueur.	24	20	3¼	2½	4½	brown
69	Clove Liqueur...............	24	10	3½	2½	4¼	brown
70 & 71*	Rosoglio, Italian............	21	10	3¾	3	3½	red
72	Ginger Liqueur.............	19	20	3¾	2½	4	brown
73 & 75*	" "	19	10	3¾	3	3½	colorless
74	Stomachic Ginger Liqueur..	19	20	3¾	4	2½	brown
76*	Spice Liqueur...............	19	10	4	2	4¼	brown
77	Vanilla Liqueur.............	24	20	3¼	2	5	brown
78	" Cream..............	29	5	3	4	3¼	colorless

* *Remark:* This is to be understood as essence made from compounded liqueur oils.

II. The Employment of Fresh Fruits for Spirits and Liqueurs

Fruit Liqueurs and Ratafias

The taste of fruit is imparted to alcoholic beverages by using the sweetened fruit juice. For this purpose the alcoholized fruit juices are best adapted, as these best yield up their aroma and flavor. The distillates of the fruits are also often used, because the flavor of the juice is sometimes not rich enough. The color must always be that natural to the juice. Artificial colors are not allowed, and neither is it permissible to substitute the fruit taste by artificial ethers. Any imitation is to be clearly stated.

Ratafias are direct macerations of fresh and selected fruits with alcohol or fruit brandies but without any corrective additions.

Genuine Pure Fruit Brandies and Their Imitations

Their large content of fruit sugar adapts the fruits for fermentation. The result obtained by distilling the mash is *genuine fruit brandy.* Only cherries and plums of all kinds contain enough natural sugar, and therefore the addition of sugar to the mash of these fruits, which would increase the alcohol content of the product, is prohibited, as is also the addition of alcohol to the mash before distilling. Otherwise the product must be declared as "cut." The other kinds of fruits contain but little sugar, and both manipulations are allowed without declaration. Reducing the distillate to the usual alcohol content with distilled water is allowed. The average alcohol content is about 7° underproof. If genuine brandies are otherwise mixed with alcohol, the product must also be declared as "cut." Adding foreign substances like volatile oils, ethers or artificial essences is prohibited, or such preparations must be stated to be *artificial* or *imitation.* To fortify genuine brandies with any such substances would be misbranding. On the other hand, in the interest of honest manufacturing, imitations are not to be recommended at all, and therefore the formulas are limited to but a few examples.

Regarding the manufacture of fruit juices, see the proper chapters under the non-alcoholic industry heading. In so far as the juices to be used for alcoholic liquids are concerned, it is recommended to preserve them by adding alcohol to the extent of 12° underproof.

So far as fruit preparations are in mind, the use of artificial substitutes, as ethers or compounded fruit ethers, should be avoided, as any preparation of volatile oils can only be reasonably used to spice the liquors and alter their taste.

(a) *Stone Fruits*

The stone fruits have hard stone kernels imbedded in a pulp, and contain one or more seeds. They contain two substances which react with each other to form bitter almond oil. This is not present naturally formed, but is a product of a reaction between the glucoside amygdalin and the ferment emulsin, whereby *hydrocyanic acid* is formed. For food purposes it is freed from the hydrocyanic acid, but the artificial bitter almond oil, benzaldehyde, in its chlorine-free form is well adapted to replace the genuine oil. The distillates of the mash of stone fruits also contain hydrocyanic acid. Benzaldehyde is known in general as "*kernel taste,*" and is used in various alcoholic beverages.

The stone fruits are cherries, plums of all kinds, apricots, peaches, bitter almonds, etc. Walnuts, even though without kernel taste, are stone fruits in a certain sense, and are added here.

Cherries

We distinguish between *sweet cherries* and *sour cherries* (agriots). Beside the kernel taste the cherries have a prominent fruit flavor, which is more pronounced if the cherries are expressed without the seed. The sweet cherries afford most flavor, particularly the darkest fruit.

1. Cherry Juice and Cherry Syrup

The fruit juice from cherries is obtained by expressing ripe fruits from a portion of which the stones have been removed. They are expressed without fermenting the mash, and the result is 60 to 70% juice. The acidity of the cherry juice differs. Light sweet cherries contain only 0.35%, dark sweet about 0.60% and agriots 1.28%, fruit acid. On the other hand, the light sweet cherries contain about 13.5% sugar, the dark sweet 10.5%, and the agriots only 8.75% sugar, on an average. Since cherry juice is most used for brandies, liqueurs, punches, etc., and also because of its dark color, which is like that of the wine, it is the practice to preserve cherry fruit juice with 15% alcohol. When cherry

fruit syrup is to be made, the fresh or else preserved juice is boiled with sugar; 7 parts of juice give with 13 parts of sugar 20 parts of syrup, after replacing the evaporated water and straining through flannel.

2. Genuine Cherry Brandies

The large amount of sugar enables the fruits to ferment easily. The seeds are only partly (about one-third) expressed with the pulp; 1 cwt. fruit yields, after distilling, about 1 to 1¼ gallon of brandy of 7° underproof. The content of hydrocyanic acid should not be below 0.0008% and not above 0.005%. The genuine cherry brandy, "Kirschwasser," is "cut" with alcohol, and merely 10% of the genuine brandy is sufficient to give a pronounced taste, but such "cuts" are to be declared.

From the fruits of the *marasca cherry* in Dalmatia a special brandy is distilled, and this with the addition of other aromatic substances is marketed as "*Maraschino Spirit,*" which is used for making the universally highly prized "Maraschino."

Imitations of cherry brandy, or any mixtures made by adding volatile oils, ethers or essences, to genuine brandy, are to be declared as "artificial."

Pure Fruit Liqueurs from Cherries

3. Cherry Ratafia

(30° underproof)

Treat 2 lb. of fully ripe and selected cherries, each perforated (by means of a needle) but not pressed, with 4 pints of wine brandy or alcohol of 7° underproof, and allow to stand for a week. Press off about 7 pints, and add 2 lb. sugar. The addition of some rum refines the product. Result 1 gallon.

4. Cherry Fruit Liqueur

(27° underproof)

Cherry Fruit Juice	3 pints
Alcohol	3 "
Sugar Syrup (60%)	4 "
	10 pints

Pure Sweetened Cherry Liqueurs from Genuine Brandy

These products contain, besides alcohol, a sufficient quantity of genuine brandies; no artificial colors or essences of any kind are allowed. The following formulas are for *ready-made beverages.*

5. Cherry Brandy Liqueur

(27° underproof)

Genuine Cherry Brandy..	1 pint
Cherry Fruit Juice......	1½ "
Alcohol................	2 "
Sugar Syrup (60%)......	2 "
Distilled Water.........	2 "
	1 gal.

6. Maraschino di Zara

(17° underproof)

Spirit Maraschino....... (Maraska Distillate)	1 pint
Alcohol.................	2 "
Sugar Syrup............	3½ "
Distilled Water.........	1 "
	1 gal.

Colorless.

7. Maraschino di Casalo

(17° underproof)

The same formula as Maraschino di Zara, but instead of adding 1 pint of water, add 1 pint of cherry fruit juice. Natural red color of the juice.

8. Genuine Cherry Flavor

The simplest manner of concentrating the flavor is to distil the natural fruit juice which has been preserved with 15% alcohol.

1 cwt. alcoholized cherry juice is distilled slowly, 20 lb. of flavor being collected; to this add 8 lb. of the same alcoholized juice and half an ounce of vanillin crystals to round out the taste. This flavor represents a four-fold concentration of the juice flavor.

If the flavor is wanted colorless, take only the distillate of 20 lb. and add half an ounce of vanillin crystals. This essence constitutes a suitable base for making all imitations of the cherry taste.

Artificial Cherry Brandies

These contain, besides genuine fruit flavors, several volatile oils and ethers, and simulate the taste of genuine brandies, but they must be declared as *artificial.* The kernel taste is reproduced by benzaldehyde.

9. Essence for Artificial Agriot Brandy

(1 oz. per gallon)

Oil of Cognac	4 dr.
" " Cinnamon	12 "
" " Cloves	1 oz.
Benzaldehyde	2 "
Rose Water	1¾ lb.
Carob Distillate	2 "
Pure Cherry Brandy	2 "
Colorless Cherry Flavor	4 "
	10 lb.

10. Essence for Artificial Cherry Brandy

(1 oz. per gallon)

Oil of Neroli	2 drops
" " Cloves	¼ dr.
" " Cinnamon	¼ "
Benzaldehyde	2 oz.
Rum Ether	14 "
Wine Brandy	1 lb.
Colorless Cherry Flavor	3 "
Genuine Bitter Almond Water	5 "
	10 lb.

11. Essence for Artificial Maraschino

(1 oz. per gallon)

Oil of Rose	½ dr.
Oil of Cinnamon	1 "
" " Neroli	1 "
Ethyl Acetate	2¾ oz.
Ethyl Nitrite	5 "
Raspberry Distillate	1¼ lb.
Wine Brandy	1¼ "
Bitter Almond Water	2 "
Colorless Cherry Flavor	2 "
Alcohol	3 "
	10 lb.

12. Artificial Maraschino (Zara type) (Ready to drink)

(About 20° underproof)

Raspberry Distillate	½ oz.
Bitter Almond Water	½ "
Rose Water	1½ "
Orange Flower Water	1½ "
Arrac	¼ pint
Wine Brandy	½ "
Pure Cherry Brandy	½ "
Alcohol	2½ "
Sugar Syrup (60%)	3 "
Distilled Water	1 "
	1 gal.

Essences for Common Cherry Liqueurs

13. Cherry Liqueur Essence

(2 oz. per gallon)

Vanillin	1½ dr.
Oil of Cloves	2 oz.
" " Cinnamon	3 "
Benzaldehyde	5 "
Rum Essence	14 "
Alcohol	1 lb.
Cherry Juice	2½ "
Cherry Flavor	5 "
	10 lb.

14. Spiced Cherry Essence

(2 oz. per gallon)

Vanillin	4 dr.
Oil of Calamus	5 "
" " Sweet Orange	5 "
" " Lemon	8 "
" " Peppermint	10 "
" " Cloves	2 oz.
" " Cinnamon	2 "
Benzaldehyde	4 "
Rum Essence	6 "
Cherry Juice	2 lb.
Alcohol	3 "
Red Cherry Flavor	4 "
	10 lb.

Plums

The various kinds of plums have, beside a pronounced kernel taste, some delicious fruit flavors, as mirabelles, green gages, prunelles, etc.; however, the usual *domestic plums* and *damsons* are also much employed, as well as the *sloes*, especially when these have been first frozen, whereby their flavor is best developed. The large amount of sugar they contain enables plums of all kinds to be mashed, and to yield a very fine fruit brandy, the *Plum or Damson Brandy.* In southern Germany especially (Black Forest) this brandy is largely used and in Austria also the plum brandy is prized as *Sliwowitz.* The typic quality of plum brandy depends upon the species of plum, upon the method of mashing and distilling and upon the storage. Just as with cherry brandy, the plum brandy may be "cut" with alcohol. Imitations are also to be declared. Only a couple of formulas for such *imitations* follow:

15. Essence for Artificial Plum, Damson, or Sloe Brandy

(1 oz. per gallon)

Oil of Cloves	1½ oz.
" " Cinnamon	1½ "
Ethyl Acetate	4 "
Benzaldehyde	6 "
Rum Ether	12 "
Peach Essence	15 "
Genuine Plum Brandy	2 lb.
Distilled Water	2½ "
Alcohol	3 "
	10 lb.

16. Essence for Artificial Sliwowitz

(1 oz. per gallon)

Oil of Cognac	2 oz.
Benzaldehyde	4 "
Rum Essence	6 "
Ethyl Acetate	8 "
Orris Root Tincture	12 "
Wine Brandy	1 lb.
Pineapple Essence	1 "
Carob Tincture (1 : 5)	2 "
Alcohol	2 "
Distilled Water	2 "
	10 lb.

Very fine extractive liqueurs are also manufactured from dried fruits, especially from plums. The following formula gives a general method for making extractive liqueurs from dried fruits, as from peach, apricot, etc. With regard to plums, the best Bosnian plums are preferred. The kernels are to be removed.

17. La Prunelle (as finished liqueur)

French Specialty (20° underproof)

Macerate 2 lb. dried seedless plums for a week with 4 pints proof spirit. Collect without pressing 3 pints extract. The

remainder, after adding 4 pints of water, is to be distilled, but only to yield 1 pint, which is added to the extract to make a total of 4 pints. From this make the finished liqueur as follows:

Extract as above	4 pints
Pure Plum Brandy	1 "
Sugar Syrup	2½ "
Distilled Water	½ "
	1 gal.

Apricots, Bitter Almonds and Peaches

Bitter Almonds contain no other aromatics than benzaldehyde, and therefore the latter is used in all cases where a bitter almond taste is wanted. *Apricots* and *peaches* contain a very pleasant flavor, which, however, is very sensitive to heat, and is therefore not suited to be distilled. The finest liqueurs are manufactured just like the ratafias as described under Cherry Ratafia, or as from the dried fruits, and in the same manner as described above under La Prunelle. For ordinary purposes the isolated fruit flavors, the so-called Fruit Flavor Oils, afford the best basis for the natural taste of these fruits. Where the kernel taste is desired, use benzaldehyde.

18. Apricot Essence

(1 oz. per gallon)

Apricot Flavor Oil	8 oz.
Wine Brandy	1 lb.
Distilled Water	4 "
Alcohol	4½ "
	10 lb.

19. Bitter Almond Essence

(1 oz. per gallon)

Benzaldehyde	5 oz.
Arrac Essence	11 "
Wine Brandy	1 lb.
Bitter Almond Water	1 "
Bitter Orange Essence	1 "
Distilled Water	2½ "
Alcohol	3½ "
	10 lb.

20. Almond Essence (for a fine liqueur for women)

(1 oz. per gallon)

Peach Flavor Oil	2 oz.
Coffee Essence, Brown	3½ "
Bitter Almond Water	3½ "
Angostura Essence	15 "
Walnut Essence	1 lb.
Wine Brandy	1 "
Cacao Essence, Brown	1 "
Bitter Orange Essence	1½ "
Plum Brandy	2 "
Nutmeg Tincture (1 : 10)	2 "
	10 lb.

Add further oil of rose and oil of neroli, of each one drop, and 1½ dr. vanillin.

21. MACAROON ESSENCE (for a delicious fancy liqueur)

(2 oz. per gallon)

Apricot Flavor Oil	2	oz.
Peach Flavor Oil	3	"
Raspberry Distillate	5	"
Wine Brandy	10	"
Coffee Essence, Brown	1¼	lb.
Artificial Maraschino Essence	2	"
Cacao Essence, Brown	2½	"
Walnut Essence	3	"
	10	lb.

22. PERSICO ESSENCE

(1 oz. per gallon.)

Oil of Lemon	¾	oz.
" " Cloves	1¾	"
" " Cinnamon	3½	"
" " Bitter Orange	4	"
Benzaldehyde	6	"
Wine Brandy	1	lb.
Grape Tincture (1 : 5)	1½	"
Peach Essence	1½	"
Distilled Water	1½	"
Alcohol	3½	"
	10	lb.

23. PEACH ESSENCE

(1 oz. per gallon)

Peach Aroma Oil	4	oz.
Wine Brandy	1	lb.
Alcohol	5	"
Distilled Water	3¾	"
	10	lb.

WALNUT

The typical aroma of walnuts is most pronounced in unripe fruits, when they are quite green and can be perforated with a needle. The flavor is not a strong one, and is generally fortified by volatile oils. The nut contains no benzaldehyde.

24. WALNUT ESSENCE FROM FRESH UNRIPE NUTS

(2 oz. per gallon)

10 lb. fresh unripe walnuts are mashed and expressed, and the juice is reserved. Then mix the residue with 4 oz. of allspice and 6 oz. of nutmeg, add 8 lb. alcohol and 1 lb. wine brandy, and let stand three days. Then percolate, and collect and reserve 8 lb. of percolate. Place the residue in the still with the juice first obtained, and distil off 2 lb., which then add to the 8 lb. of percolate; lastly add 1 dram vanillin.

It is recommended to fortify this pure natural essence with one-third of the following essence from volatile oils:

25. Walnut Essence from Volatile Oils

(2 oz. per gallon)

Benzaldehyde	3 dr.
Oil of Mace	1 oz.
" " Cinnamon	1 "
" " Cloves	2 "
" " Sweet Orange	12 "

Distil the oils with the use of the return tube, using 2 gallons of alcohol and $3\frac{1}{2}$ gallons of water.

After one hour distil off 4 gallons, filter quite clear by aid of infusorial earth, and rectify after adding

Wine Brandy	2 lb.

to a yield of 18 lb., which mix further with 2 lb. alcohol, to avoid subsequent cloudiness, to the final result of 20 lb.

Compounded Volatile Oils for Liqueurs with the Taste of Cherry, Bitter Almonds, Plum and Walnut

Even though the most pronounced taste is reproduced only by use of the natural fruit material, the following compounds of volatile oils are adapted to imitate the natural essences and to fortify them. They are employed by dissolving one oz. in 15 oz. of alcohol of 13° overproof. If the solution is cloudy, filter by aid of infusorial earth. Of this essence one oz. will suffice for a gallon of the finished drink.

26. Compound Liqueur Oil for Spice Cherry Liqueur

Oil of Calamus	$\frac{1}{2}$ oz.
" " Sweet Orange	$\frac{1}{2}$ "
" " Peppermint	1 "
" " Cloves	1 "
" " Cinnamon	$1\frac{1}{2}$ "
Benzaldehyde	$11\frac{1}{2}$ "
	1 lb.

27. Compound Liqueur Oil for Nalewka (a Polish specialty)

Oil of Cinnamon	$1\frac{1}{2}$ oz.
" " Cloves	2 "
Benzaldehyde	$4\frac{1}{2}$ "
Absolute Alcohol	8 "
	1 lb.

28. Compounded Liqueur Oil for Maraschino

Oil of Rose	$1\frac{1}{2}$ dr.
" " Neroli	$1\frac{1}{2}$ "
" " Cinnamon	5 "
" " Bitter Orange	$4\frac{1}{2}$ oz.
Benzaldehyde	5 "
Oil of Lemon	6 "
	1 lb.

29. Compound Liqueur Oil for Sliwowitz (Austrian Specialty)

Cognac Oil	$1\frac{1}{2}$ oz.
Fusel Oil	$2\frac{1}{2}$ "
Benzaldehyde	12 "
	1 lb.

30. Compound Liqueur Oil for Persico

Oil of Lemon	1¼ oz.
" " Sweet Orange	2 "
Benzaldehyde	3¾ "
Oil of Cloves	4 "
" " Cinnamon	5 "
	1 lb.

31. Compound Liqueur Oil for Walnut

Benzaldehyde	¼ oz.
Oil of Mace	¾ "
" " Cinnamon	1 "
" " Cloves	2 "
" " Sweet Orange	12 "
	1 lb.

(*b*) *Kernel Fruits*

Regarding the kernel fruits, only the taste of pears is reproduced in essences for alcoholic beverages, of which the better qualities are manufactured as ratafias by treating the fresh, selected fruits with wine brandy. *Apples, pears* and *quinces* are treated in such manner, and afford delicious table liqueurs.

The only *Pear Liqueurs* used are merely artificial products, aromatized with amyl acetate, but of the latter it is recommended to use only traces.

Pear Essences

32 Imperial Pear Essence

(1 oz. per gallon)

Vanillin	½ dr.
Amyl Acetate	1½ "
Raspberry Distillate	5 oz.
Bergamot Essence	11 "
Orange Flower Water	1 lb.
Wine Brandy	1 "
Distilled Water	2½ "
Alcohol	4½ "
	10 lb.

33. Muscade Pear Essence

(1 oz. per gallon)

Oil of Neroli	½ dr.
Amyl Acetate	1½ "
Vanillin	6 "
Nutmeg Tincture	5½ oz.
Woodruff Essence	10 "
Elder Flower Tincture	1 lb.
Wine Brandy	1 "
Orange Flower Water	1 "
Distilled Water	2 "
Alcohol	4 "
	10 lb.

(*c*) *Berries of All Kinds*

Berries are distinguished by their large amount of juice, which, however, bears only a part of the natural flavor, the largest part remaining in the flesh. The essences for non-alcoholic beverages are distilled from the whole berries or the flesh only. For making alcoholic beverages it suffices to distil an essence of fresh fruits as follows:

34. Raspberry Distillate

(Raspberry Spirit)

1 cwt. fresh raspberries are distilled with 20 gallons alcohol of 30° underproof, 10 gallons of distillate being collected.

35. Raspberry Flavor from Fruit Juice

10 gallons raspberry juice, fresh, not preserved or spirited, are distilled slowly with 1 gallon of alcohol to a yield of 8 lb., to which are further added 2 lb. raspberry juice to afford a final essence of 10 lb.

Remark: All kinds of berries may be treated in exactly the same manner to obtain the various essences.

Berry Fruit Juice Liqueurs of the best grade are best manufactured as ratafias in the same manner as Cherry Ratafia. Second-grade berry liqueurs are made from fruit juices with the addition of any distillate as above described, with alcohol only, or in cases of better quality, with the addition of fruit brandies obtained by fermenting berries with added sugar or by the distillation of fermented berries with little alcohol.

These fruit liqueurs are much sweetened, and in general are manufactured as follows, raspberries being taken as an example.

Of course all kinds of berries may be worked up according to the same rules, if distillates, juices or genuine brandies of the fruits are at hand.

36. Raspberry Liqueur

(32° underproof)

Raspberry Distillate....	¼ pint
Raspberry Juice........	2 "
Alcohol...............	2½ "
Sugar Syrup (60%).....	4 "
Distilled Water........	1½ "
	About 1 gal.

37. Raspberry Table Liqueur

(27° underproof)

Raspberry Distillate....	¼ pint
Pure Raspberry Fruit Brandy.............	½ "
Raspberry Juice.......	2 "
Alcohol...............	3 "
Distilled Water........	¾ "
Sugar Syrup...........	4 "
	About 1 gal.

The most important of the liqueurs made along these lines are *black and red Bilberry, Raspberry, Sorbapples* (as Jarcebinka, a Polish specialty) and *Strawberry. Blackberry Brandy* in particular is much liked. *Grenadine* is manufactured from the juice of pomegranate fruits, but without the use of any distillate, because the fruits have no flavor other than that present in the juice itself; in this case the quantity of distillate ordinarily employed is substituted by the same quantity of raspberry distillate. Some kinds of berries, as bilberries, have only a slightly pronounced flavor, and therefore the taste is fortified by aromatization with some

foreign distillate and a fine bitter flavor, as, for instance, Angostura Essence.

38. Bilberry Essence, Black

Angostura Essence	½	lb
Strawberry Distillate	1½	"
Bilberry Distillate, Black	8	"
	10	lb.

39. Bilberry Essence, Red

Angostura Essence	½	lb.
Raspberry Distillate	1½	"
Bilberry Distillate, Red	8	"
	10	lb.

40. Wild-fruit Essence

Sweet Orange Essence	1	lb.
Lemon Essence	1	"
Wine Brandy	1	"
Raspberry Distillate	3	"
Strawberry Distillate	4	"
	10	lb.

With regard to currants, only the *black currants* are used, but the juice must be fermented in every case, and before distilling the berries, because the taste develops only when the fruit is fermented. The *Groseille liqueur* made from black currants is much prized as a stomachic.

Supplement: Tropical Fruits (Banana and Pineapple)

41. Banana Essence

(5 oz. per gallon)

Macerate 10 lb. of peeled bananas, which must not be over-ripe, with 10 lb. of alcohol of 23° overproof. Press off after a week about 8 lb., and add 2 lb. pure wine brandy and ½ oz. vanillin.

The taste is not a strong one, and therefore 5 oz. per gallon is necessary. Fortifying with ethers, as ethyl butyrate, is not to be recommended.

42. Pineapple Essence

(2 oz. per gallon)

10 lb. of fresh pineapples are peeled. The 2 lb. of peels obtained are ground, and macerated with 2 lb. alcohol for three days. In the meantime the peeled fruit is ground and expressed, yielding about 6 lb. of juice. This juice is not suitable for essences, but is suitable for punches and cups, and it must be at once preserved with about 1 lb. alcohol. The residue is macerated with 2 lb. alcohol, and is expressed off just before expressing the macerated peels. Then the already extracted peels are once more macerated with the extractive fluid from the residue for one day and then expressed off. Both the first and second extracts from the peels are united, and made up to 5 lb. by addition of some

wine distillate if necessary. Finally ½ oz. vanillin is dissolved in the essence.

Remark: Of course the finest pineapple table liqueurs are obtained by the method used for ratafias. In no case should the delicious aroma be substituted by artificial fruit ethers.

The manufacture of fruit essences or preparations of fresh fruits is limited to the season when the fruits are ripe. Otherwise the juice only is used, or pure brandies from the fruits are employed. The fineness of the fruit liqueurs depends entirely upon the selection of the fruits with regard to their species and their good condition. Rotten fruits will always impair the flavor. The addition of some pure brandies, as rum and arrac, will refine the products.

COMPOSITION OF LIQUEURS WITH FRUIT TASTE
For 10 gallons

Essence formula No.		Alcohol content under-proof.	Quantity of essence.	Alcohol 38° over-proof.	Sugar syrup, 60%.	Water.	Color.
	Cherry Taste	Degree	Oz.	Gal.	Gal.	Gal.	
9	Agriot Brandy, artificial	15	10	4¼	¼	5¾	colorless
10	Cherry Brandy, artificial	12	10	4½	¼	5½	"
11 & 27*	Maraschino, artificial	20	10	3¾	4	2½	"
13	Ordinary Cherry Liqueur	15	20	4¼	¼	5¼	½ gal. cherry juice
13	Sweet Cherry Liqueur	20	20	3¾	2	3½	1 gal. juice
14 & 26*	Spiced Cherry Liqueur	20	20	3¾	2	3½	1 gal. juice.
28*	Nalewka	30	10	2½	2½	3¼	2 gal. juice.
	Plum Taste						
15	Plum, Damson, or Sloe Brandy, artificial	17	10	4	¼	6	colorless
16 & 29*	Sliwowitz, artificial	17	10	4	¼	6	"
	Other Stone Fruit Taste						
18	Apricot	24	10	3½	3	3¾	light yellowish
19	Bitter Almond	29	10	3	3	4¼	colorless
20	Almonds	24	10	3¼	3	4	light green
21	Macaroon Liqueur	24	20	3¼	4	3	light yellowish
22 & 30*	Persico	24	10	3¼	3	4	colorless
23	Peach	24	10	3¼	4	3	orange
24, 25 & 31*	Walnut	20	20	3¾	2½	4	brown-green
	Kernel and Exotic Fruits						
32 & 33	Pear (Imperial and Muscade)	24	10	3½	3½	3¼	green-yellow
41	Banana	24	10	3½	2½	4¼	light-yellow
42	Pineapple	24	10	3½	3	3¾	yellow

* With compound essential oils use their solutions (1 oz. per pound) as essence.

III. Spirits with Simple Leading Extractive Aroma

This group contains but few members. The employment is mostly limited to the extractives, because their flavors are not volatile, or are very difficultly so.

(a) *Woodruff*

1. Woodruff Essence from Fresh Plants

(1 oz. per gallon)

The flavor contained in the flavoring tops of fresh woodruff is cumarin, identical with that present in tonka beans and new mown hay; for most purposes it is manufactured artificially, but the natural taste of woodruff is liked very much for cups. Woodruff is not suited for distillation.

$7\frac{1}{2}$ lb. fresh flowering woodruff tops are crushed and expressed as sharply as possible. The juice is worthless, as its taste is grassy. The residue of the plants is mixed with 4 oz. ground tonka beans and treated with

Alcohol	4 lb.
Grape Tincture	2 "
Pineapple Essence	1 "
Wine Brandy	1 "
Orange Flower Water	4 oz.

After allowing to stand for three days express off about 10 lb.

This essence is used mostly for wine bowls and refreshing cold alcoholic beverages.

2. Artificial Woodruff Essence

(1 oz. per gallon)

Cumarin	1 oz.
Warm Alcohol	15 oz.

Dissolve, then add

Alcohol	$3\frac{1}{2}$ lb.
Tonka Bean Tincture (1 : 5)	1 "
Distilled Water	$4\frac{1}{2}$ "
	10 lb.

This class contains the flavor of stimulant drugs such as contain either caffeine (*e.g.*, cacao, coffee), coca or cocaine, kola and tea. Their stimulant action combined with the delicious flavor is very much in favor with ladies for dessert liqueurs.

3. Coca Essence

(1 oz. per gallon)

Tonka Bean Tincture	½ lb.
Vanilla Liqueur Essence	1 "
Bitter Orange Distillate	1½ "
Coca Tincture (1 : 5)	3 "
Lemon Distillate	4 "
	10 lb.

4. Cacao Essence, Brown

(2 oz. per gallon)

Roasted and ground cacao beans which are used in chocolate manufacture are better suited than the powdered and deolcated cacao.

Cacao Beans	5 lb.
Alcohol	7½ "
Water	7½ "

Percolate for three days and, using sufficient water subsequently, collect 20 lb. of percolate.

This percolate, to which are added

Cinnamon Tincture	1 oz.
Arrac	2 lb.

is used as medium for a further percolation of 5 lb. cacao beans to yield of 20 lb.

Then add

Vanillin .... 3 dr.

Remark: The flavor of cacao is distillable only with loss, and in most cases, where the color is immaterial, this brown essence is to be preferred.

5. Cacao Essence, Colorless

(3 oz. per gallon)

Cacao Essence, Brown (as above)	10 lb.
Alcohol	3 "
Water	3 "

Distil off 10 lb. and dissolve in the distillate 3 dr. vanillin. Result 10 lb.

This colorless essence is suitable for delicious creams and dessert liqueurs.

6. Chocolate Essence for Pralinée Liqueur

(2 oz. per gallon)

Cardamom Tincture	½ lb.
Clove Tincture	¼ "
Cinnamon Tincture	½ "
Brown Cacao Essence	9 "
Vanillin	3 dr.
	10 lb.

If this essence is wanted colorless, use the colorless cacao essence and above other ingredients. No essential oils should be substituted for the tinctures of the spices.

7. Coffee Essence, Brown

(2 oz. per gallon)

Best, and freshly roasted, Coffee Beans	5 lb.
Alcohol, 27° underproof	10 "

Let stand one day, then percolate, using sufficient water subsequently to obtain 10 lb. percolate.

With this percolate mix

Cinnamon Tincture	5 oz.
Mace Tincture	5 "
Pure Wine Brandy	1 lb.
Pure Arrac	1½ "

and with this mixture, percolate 5 lb. coffee as before, to obtain a second percolate of 10 lb. essence.

The remark under Cacao Essence applies here also.

8. Coffee Essence, Colorless

(3 oz. per gallon)

Brown Coffee Essence (as above)	10 lb.
Alcohol	3 "
Water	3 "

Distil to yield a final result of 10 lb. Essence.

9. Cola Nut Essence

(2 oz. per gallon)

Bergamot Liqueur Essence	¼	lb.
Sweet Orange Distillate...	1	"
Tonka Bean Tincture.....	1	"
Vanilla Liqueur Essence ..	1	"
Cola Nut Tincture (1 : 5)..	4	"
Bitter Orange Distillate...	2¾	"
	10	lb.

10. Tea Essence

(2 oz. per gallon)

Black Ceylon Tea.........	3 lb.
Dried Rose Flowers.......	5 oz.

Percolate with

Lemon Distillate.........	3	oz.
Vanilla Tincture.........	5	"
Arrac....................	1	lb.
Wine Brandy............	1	"
Pineapple Essence........	1½	"
Orange Flower Water.....	1½	"
Alcohol.................	1½	"
Rose Water.............	2½	"

The percolation should require three days, with the subsequent addition of sufficient water to yield 10 lb. essence.

Regarding colorless Tea Essence, see the remark under Cacao Essence.

Composition of Liqueurs with the Taste of Woodruff and Stimulants

Remark: The stimulant liqueurs are used very sweet, and if colorless they are designated Creams (Crêmes) or Huiles, constituting delicious specialties for dessert liqueurs.

For 10 gallons

Essence formula No.		Content of alcohol under-proof.	Quantity of essence.	Alcohol 38° over-proof.	Syrup, 60%.	Water.	Color.
		Degree	Oz.	Gal.	Gal.	Gal.	
1	Genuine Woodruff Liqueur	22	10	3½	3	3¾	green, and 2 gal. white wine or apple juice
2	Artificial Woodruff Liqueur	22	10	3¾	3	3½	green
3	Coca Liqueur.........	19	10	4	2	4¼	brown
4	Cacao Liqueur, brown	24	20	3½	3	3¾	"
5	Cream of Cacao.......	29	30	2¾	4	3½	colorless
6	Chocolate (Pralinée) ..	29	30	2¾	4	3½	brown
6	Cream of Chocolate...	29	30	2¾	4	3½	colorless
7	Coffee, Brown.........	24	20	3½	3	3¾	brown
8	Cream of Coffee........	29	30	2¾	4	3½	colorless
9	Kola Liqueur.........	19	20	4	1½	4¾	olive-green
10	Tea Liqueur, Brown..	24	20	3½	3	3¾	light-brown
10	Cream of Tea.........	29	30	2¾	3	4½	colorless

IV. Aromatic Waters

These so-called alcoholics are manufactured from volatile oils or compounded liqueur oil compounds. The best results, regarding fineness, are obtained by distillation of the aromatic

drugs. In some cases the latter preparations are substituted by volatile oils.

There exists a further distinction regarding the taste. That of most of the aromatic waters is volatile in character, and only a few of the waters are of a light bitter type. Some aromatic water essences are mixtures of various kinds.

The French specialties vary according to their origin. Their manufacture is simplified by standard methods as follows:

Method A. — Volatile Oils as Raw Material for Aromatic Waters

The formulas are always calculated on 1 lb., of which 1 oz. is sufficient for 1 lb. of essence, and thereof 1 oz. is required for 1 gallon of liquid.

In the simplest cases 1 oz. of the compounded oil is dissolved in 15 oz. alcohol of 13° overproof, and clarified if cloudy. The better and finer essences are obtained by distillation of the oils with alcohol according to the following method:

1 lb. of the compounded oils as prescribed is mixed in a still with

Alcohol	1 gal.
Water	2 "

and then distilled with the aid of the return tube.

2 gallons of distillate are collected, which are mixed with 1 gallon of water, and after filtration with infusorial earth, rectified to yield about 1½ gallons, to which is then added sufficient alcohol to obtain finally 10 lb. by weight.

This essence will not render turbid any alcohol, and contains only the finest portions of the flavor. 1 oz. is required to afford 1 gallon of the finished beverage.

Method B. — Vegetable Distillates from Drugs

This method affords the finest results, exhausting all of the flavor. The quantity of the drugs varies, and in the formulas the weight of the drugs is based on the final result of 5 gallons in every case. The first formula of this kind — as for example Gold Water of Danzig — shows the method once and for all. Of these vegetable distillates ½ gallon is required to make 10 gallons of the finished beverage.

Mixed Essences for Aromatic Waters

Only some aromatic essences, such as of rose oil, of violet flavor, and mastic essence, are compounded by simple solution or mixture of the ingredients.

(*a*) *Volatile Oils as Raw Material for Aromatic Waters*

Employment: Method A.—1 oz. of the compounded liqueur oil is sufficient for 1 lb. essence, whereof 1 oz. is required to yield a gallon of the finished beverage.

1. Compound Liqueur Oil for Alkermes Liqueur

Oil of Rose	¼ oz.
" " Neroli	¼ "
" " Cloves	2 "
" " Mace	3 "
" " Cinnamon	4 "
" " Bay Laurel	6½ "
	1 lb.

2. Compound Liqueur Oil for Captain Water

Oil of Angelica	2 dr.
" " Cloves	3 "
" " Sweet Orange	3 "
" " Cardamom	5 "
" " Lemon	7 "
" " Fennel	8 "
" " Calamus	1¼ "
" " Anise	1½ "
" " Mace	1½ "
" " Caraway	10 oz.
	1 lb.

3. Compound Liqueur Oil for Cordial Liqueur of Danzig

Roman Chamomile Oil	1 dr.
Oil of Mace	1 "
" " Angelica	14 "
" " Cloves	1 oz.
" " Peppermint	1 "
" " Caraway	2½ "
" " Fennel	3½ "
" " Star Anise	7 "
	1 lb.

4. Compound Liqueur Oil for Cordial Medoc Liqueur

Oil of Rose	3 drops
" " Cardamom	1½ dr.
" " Coriander	6½ "
" " Calamus	1 oz.
" " Cinnamon	3 "
" " Cloves	3¼ "
" " Lemon	4 "
" " Bitter Orange	8 "
	1 lb.

5. Compound Liqueur Oil for Gold Water of Danzig

Oil of Rose	1 dr.
" " Lemon	7 "
" " Coriander	8 "
" " Calamus	1½ "
" " Cloves	1½ "
" " Cinnamon	1½ "
" " Caraway	2½ "
" " Bitter Orange	3 "
" " Star Anise	5 "
	1 lb.

6. Compound Liqueur Oil for Railway Liqueur of Munich

Oil of Sweet Orange	10 dr.
" " Coriander	10 "
" " Bitter Orange	12 "
" " Wormwood	1 oz.
" " Calamus	1 "
" " Cloves	2 "
" " Star Anise	5 "
" " Peppermint	5 "
	1 lb.

7. Compound Liqueur Oil for Riga Balsam (Russian Specialty)

Oil of Mustard Seed	1 dr.
" " Thyme, Red	15 "
" " Marjoram	1 oz.
" " Lovage	2 "
" " Lemon	2 "
" " Elecampane	8 "
Saffron Tincture (1 : 5)	2 "
	1 lb.

8. Compound Liqueur Oil for Sergeant Liqueur

Oil of Cubebs	6 dr.
" " Mace	10 "
" " Cloves	2 oz.
" " Lemon	2 "
" " Cinnamon	3½ "
" " Sweet Orange	3½ "
" " Bitter Orange	4 "
	1 lb.

9. Compound Liqueur Oil for Water-cress Liqueur

Oil of Coriander	½ dr.
" " Rose	1 "
" " Calamus	1 "
" " Mace	1½ "
" " Petitgrain	2 "
" " Cloves	4 "
" " Cinnamon	4 "
" " Allspice	8 "
" " Star Anise	10 "
" " Sweet Orange	2 oz.
" " Lemon	3 "
" " Bitter Orange	9 "
	1 lb.

French Specialties

10. Compound Liqueur Oil for Eau Céleste

Oil of Neroli	¾ oz.
" " Cloves	1¾ "
" " Coriander	2 "
" " Cardamom	2 "
" " Lemon	4½ "
" " Anise	5 "
	1 lb.

11. Compound Liqueur Oil for Eau des Favorites

Oil of Rose	3 drops
" " Neroli	1 dr.
" " Lemon	7 "
" " Cloves	8 "
" " Mace	8 "
" " Cardamom	8 "
" " Cinnamon	2 oz.
Alcohol, Absolute	12 "
	1 lb

12. Compound Liqueur Oil for Eau de la Côte

Oil of Peppermint	2 oz.
" " Bergamot	3½ "
" " Cinnamon	4½ "
" " Lemon	6 "
	1 lb.

13. Compound Liqueur Oil for Parfait d'Amour

Oil of Rose	10 dr.
" " Neroli	10 "
" " Mace	12 "
" " Sweet Orange	1 oz.
" " Lemon	1½ "
Benzaldehyde	2 "
Oil of Cloves	2½ "
" " Cinnamon	3 "
" " Calamus	4 "
	1 lb.

Bitter Specialties

14. Compound Liqueur Oil for Bavarian Alpine Herbs Liqueur

Oil of Anise	1 dr.
" " Cardamom	1½ "
" " Caraway	2 "
" " Cloves	2½ "
" " Wormwood	3 "
" " Coriander	4 "
" " Fennel	6 "
" " Bitter Orange	12 "
" " Lemon	1 oz.
" " Calamus	2 "
" " Angelica	2½ "
" " Cinnamon	2 "
" " Sweet Orange	6½ "
	1 lb.

15. Compound Liqueur Oil for Berlin Double Bitters

Oil of Angelica	½ oz.
" " Cinnamon	½ "
" " Cloves	½ "
" " Ginger	1 "
" " Calamus	3 "
" " Bitter Orange	3½ "
" " Wormwood	7 "
	1 lb.

16. Compound Liqueur Oil for Danzig Cordial Drops

Oil of Mace	1½ dr.
" " Roman Chamomile	2 "
" " Peppermint	12½ "
" " Cloves	1 oz.
" " Angelica	1 "
" " Caraway	3 "
" " Fennel	4 "
" " Star Anise	6 "
	1 lb.

17. Compound Liqueur Oil for Elixir de Spaa

Oil of Elecampane	1 dr.
" " Cloves	2 "
" " Mace	2 "
" " Marjoram	4 "
" " Galanga	7 "
" " Angelica	12 "
" " Caraway	1½ oz.
" " Calamus	1¾ "
" " Coriander	2 "
" " Lemon	4 "
" " Sweet Orange	6 "
	1 lb.

18. Compound Liqueur Oil for Kontuszowka (Polish Specialty)

Oil of Rose	3 drops
" " Neroli	3 "
" " Coriander	4 dr.
" " Peppermint	6 "
" " Lemon	6 "
" " Fennel	1 oz.
" " Caraway	2 "
" " Wormwood	2 "
" " Juniper	2 "
" " Anise	3 "
" " Star Anise	5 "
	1 lb.

19. Compound Liqueur Oil for White Stomach Water

Oil of Neroli	10 drops
" " Juniper	2 oz.
" " Cloves	2 "
" " Coriander	2 "
" " Angelica	2 "
" " Calamus	4 "
" " Wormwood	4 "
	1 lb.

(b) *Vegetable Distillates for Making Aromatic Waters*

These are made according to the following example for Danzig Golden Water:

20. Vegetable Distillate for Danzig Golden Water

Nutmeg	1	lb.
Cardamom	1½	"
Coriander	2	"
Cinnamon Bark	2½	"
Juniper Berries	10	"
Fresh Lemon Peel	20	"

Distil with 8 gallons alcohol of 17° underproof for some time with return of the distillate. Afterwards distil off 8 gallons, with the usual addition of water, then filter with infusorial earth, and finally rectify the filtrate to a yield of 5 gallons.

The vegetable distillates are used in the proportion of ½ gallon to 10 gallons of the finished beverage.

In the further formulas only the quantities of the various drugs are given, and the latter are worked in same manner as in the above example.

21. Vegetable Distillate for Danzig Baal Water

Vanilla Beans	½	lb.
Cloves	1	"
Ginger	2	"
Gentian Root	2	"
Galanga Root	2	"
Star Anise	2	"
Fennel	2	"
Rosemary Leaves	2	"
Allspice	2	"
Cassia Cinnamon	5	"
Sage Leaves	5	"
Sweet Orange Peel	5	"

22. Vegetable Distillate for Carmelite Spirit

Nutmeg	2	oz.
Mace	4	"
Cloves	5	lb.
Cinnamon Bark	5	"
Coriander	10	"
Angelica Root	10	"
Thyme	10	"
Sage	10	"
Rosemary	10	"
Hyssop	10	"
Fresh Flowering Balm Herb	15	"

23. Vegetable Distillate For Christophelet

Cardamom	1	lb.
Cloves	1	"
Coriander	1½	"
Cinnamon	2½	"
Violet Root	2½	"
Cubebs	2½	"
Paradise Brains	2½	"
Rosemary	2½	"
Sage	3½	"
Balm Herb, dried	4	"
Red Rose Leaves	4	"

24. Vegetable Distillate for Danzig Cordial

Cinnamon Bark	1	lb.
Cloves	1	"
Nutmeg	1	"
Mace	1	"
Violet Root	3	"
Anise	3	"
Fennel	3	"
Balm Herb, dried	5	"
Fresh Lemon Peel	30	"

French Specialties

25. Vegetable Distillate for Eau de Batave

(Batavian Water)

Cloves	½	lb.
Nutmeg	2	"
Cinnamon	3	"
Fresh Lemon Peel	7½	"
Juniper Berries	10	"

26. Vegetable Distillate for Eau de Bouquet

Star Anise	½	lb.
Cloves	½	"
Nutmeg	½	"
Rosemary	½	"
Vanilla Beans	½	"
Cinnamon	1½	"
Lavender	1½	"
Orange Flowers	2½	"
Orris Root	3½	"
Bitter Orangė Peels	3½	"
Fresh Lemon Peels	7	"

27. Vegetable Distillate for Eau de Fantaisie

Cloves	½	lb.
Cubebs	½	"
Cardamom	2	"
Cinnamon	3	"
Pistachio Nuts, Shelled	3	"
Fresh Sweet Orange Peel	15	"

28. Vegetable Distillate for Eau d'Orient

(Eskubak)

Bitter Almonds	1	lb.
Allspice	2	"
Paradise Grains	2	"
Bitter Orange Peels	9	"
Carob	9	"
Dates	9	"
Figs	12	"

29. Vegetable Distillate for Eau de Paradise

Cinnamon	½	lb.
Cardamom	½	"
Mace	1½	"
Calamus Root	1½	"
Orris Root	2	"
Angelica Root	3	"
Bitter Orange Fruit	5	"
Fresh Lemon Peel	20	"

30. Vegetable Distillate for Eau de Portugal

(Portugal Water)

Cloves	1	lb.
Cinnamon Bark	1	"
Coriander Seed	1½	"
Sweet Orange Peel	10	"

31. Vegetable Distillate for Eau de Sultan (Sultan Water)

Bitter Orange Fruits	2	lb.
Dates	4	"
Orange Flower	4	"
Figs	8	"
Lemon Peel	8	"
Curaçao Peels	8	"

32. Vegetable Distillate for Eau Divine (Divinity Water)

Mace	1	lb.
Cardamom	1	"
Coriander Seed	3½	"
Fresh Lemon Peel	20	"

33. Vegetable Distillate for Parfait d'Amour

Rosemary	1½	lb
Cloves	1½	"
Mace	1½	"
Cardamom	1½	"
Cinnamon	3	"
Bitter Orange Peels	4	"
Lemon Peels	6	"

Bitter Specialties

34. Vegetable Distillate for Bertram Bitters

Cloves	¾	lb.
Cardamom	¾	"
Galanga Root	1	"
Cinnamon	1	"
Nutmeg	1	"
Calamus Root	1½	"
Cassia Cinnamon	1½	"
Angelica Root	1½	"
Mace	2½	"
Lemon Peel	3	"
Bitter Orange Fruit	3	"
Gentian Root	3	"
Bitter Orange Peel	7½	"

35. Vegetable Distillate for Brahma Bitters

Saffron	4	oz.
Nutmeg	1	lb.
Cloves	1	"
Paradise Grains	1	"
Cardamom	1	"
Orris Root	1½	"
Coriander	1½	"
Cinnamon	2	"
Dates	3½	"
Galanga Root	5	"
Cubebs	5	"
Figs	7½	"
Grapes	7½	"
Lemon Peels	10	"
Bitter Orange Fruits	10	"

36. Vegetable Distillate for Carminative Liqueur

Cardamom	½	lb.
Ginger	1	"
Calamus Root	1	"
Balm Herb	2	"
Coriander	2	"
Fennel	2	"
Anise	2½	"
Juniper Berries	3	lb.
Bitter Orange Peels	3	"
Lemon Peels	3	"

37. Vegetable Distillate for Danzig Cordial

Cardamom	4	oz.
Zedoary Root	1	lb.
Ginger	1	"
Calamus Root	2	"
Elecampane Root	2½	"
Centuary Herb	2½	"
Horse Mint	3	"
Bitter Orange Peels	3½	"
Galanga Root	5	"
Buckbean Leaves	5	"
Gentian Root	6	"

38. Vegetable Distillate for Greek Bitters

Cassia Cinnamon	2	lb.
Wormwood	2	"
Mace	2	"
Cloves	2	"
Cardamom	2	"
Angelica Root	2	"
Calamus Root	4	"
Bitter Almonds	5	"

39. Vegetable Distillate for Krambambuli

Nutmeg	½	lb.
Allspice	1	"
Cubebs	1	"
Bitter Almonds	1	"
Paradise Grains	1	"
Cloves	2	"
Cinnamon	2	'
Wormwood	2½	"
Roman Chamomile	2½	"
Zedoary Root	2¾	"
Galanga Root	2¾	"
Bitter Orange Peels	10	"
Lemon Peel	10	"

(c) *Essences for Aromatic Waters (Simple Mixtures)*

40. Bulgarian Mastic Essence (Raki)

(1 oz. per gallon)

Mastic	5 oz.
Alcohol	2 lb.

Dissolve, and add

Oil of Cognac	5 drops
" " Neroli	5 "
" " Star Anise	2½ oz.
" " Anise	8½ "
Pure Rum	1 lb.
Wine Brandy	1 "
Alcohol	5 "
	10 lb.

41. Turkish Mastic Essence (Raki)

(1 oz. per gallon)

Mastic	4 oz.
Alcohol	2 lb.

Dissolve, and add

Oil of Coriander	½ dr.
" " Sweet Orange	¾ "
Tincture Ambergris	2 "
Oil of Anise	3 oz.
" " Star Anise	5 "
Wine Brandy	1¼ "
Alcohol	6 "
	10 lb.

42. Essence for Rose Liqueur

(1 oz. per gallon)

Vanillin	¼ dr.
Oil of Lemon	4 "
Oil of Sweet Orange	8 dr.
" " Rose	8 "
Alcohol	6½ lb.

Dissolve and add

Grape Tincture	1 "
Wine Brandy	1 "
Orange Flower Water	1½ "
About	10 lb.

43. Essence for Violet Liqueur

(1 oz. per gallon)

Vanillin	¼ dr.
Oil of Cinnamon	½ dr.
" " Neroli	1 "
Ionone (10% solution)	1 "
Alcohol	1¼ lb.

Dissolve and add

Orris Root Tincture	3 lb.
Water	4 "

Filter the mixture with infusorial earth, and add to the clear filtrate

Pineapple Essence	1 lb.
Wine Brandy	1 "
	10 lb.

44. Compound Liqueur Oil for Rose Liqueur

(To be used like the compound oils in general.)

Oil of Rose	½ oz.
" " Lemon	1 "
" " Sweet Orange	1 "
Absolute Alcohol	13½ "
	1 lb.

Composition of Aromatic Waters Using Vegetable Distillates, or Essences Made from Volatile Oils from Liqueur Oils

In case of Vegetable Distillates ½ gallon for 10 gallons,* or of Essences from Volatile Oils (10 ounces per gallon).

Essence formula No.		Alcohol under-proof, deg.	Quantity of essence or distillate.	Alcohol 38° over-proof.	Syrup sugar, 60%.	Water.	Color and other additions.
				Gal.	Gal.	Gal.	
1*	Alkermes	24	10 oz.	3¼	3½	3½	light green
2	Baal Water	21	½ gal.	3½	3	3¾	red
2*	Captain Water	24	10 oz.	3¼	1	6	red
22	Carmelite Spirit	17	½ gal.	3¾	3	3½	yellow-green
23	Christophelet	17	½ "	3¾	3	3½	red
24	Danzig Cordial	22	½ "	3½	1½	4¾	½ gal. cherry juice
3*	" "	22	10 oz.	3¾	1½	4½	½ gal. cherry juice
4*	Medoc Cordial	19	10 "	3½	2½	3¼	½ gal. cherry juice and ½ gal. claret wine
20	Danzig Golden Water	21	½ gal.	3½	2	4¾	colorless
5*	" " "	21	10 oz.	3¾	2	4½	"
40	Bulgarian Mastic (Raki)	15	10 "	4¼	1	5	colorless
41	Turkish Mastic	15	10 "	4¼	1	5	"
6*	Munich Railway Liqueur	24	10 "	3¼	2	5	violet
7*	Riga Balsam	24	10 "	3¼	3	4	dark brown or yellow
42	Rose Liqueur	24	10 "	3¼	3	4	rose
44*	" "	24	10 "	3¼	3	4	"
43	Violet Liqueur	24	10 "	3¼	4	3	violet
9*	Water Cress	22	10 "	3¾	3½	3	yellowish-green
	French Specialties						
10*	Eau de Celeste	24	10 oz.	3¼	3	4	light-yellow
25	" " Batave	24	½ gal.	3	3	4¼	colorless
26	" " Bouquet	24	½ "	3	3	4¼	light-green
11*	" " la Côte	24	10 oz.	3¼	3	4	yellow
27	" " Fantaisie	24	½ gal.	3	3	4¼	violet
12*	" des Favorites	24	10 oz.	3¼	3	4¼	rose
28	" d'Orient	24	½ gal.	3	3	4¼	colorless
29	" de Paradise	24	½ "	3	3	4¼	light-green
30	" " Portugal	24	½ "	3	3	4¼	yellow
31	" " Sultan	24	½ "	3	3	4¼	dark red
32	" Divine	24	½ "	3	3	4¼	yellow
33	Parfait d'Amour	24	½ "	3	3	4¼	red
13*	" "	24	10 oz.	3¼	3	4	red
	Bitter Aromatic Waters						
14*	Bavarian Alpine Herbs Bitters	19	10 oz.	3¾	1½	5	brown-green
34	Bertram Bitters	15	½ gal.	4½	¾	4½	½ gal. cherry juice
35	Brahma Bitters	15	½ "	4½	2½	3¼	brown
36	Carminative Liqueur	19	½ "	3½	2	4¾	red-brown
37*	Danzig Cordial	19	10 oz.	3¾	1	5½	brown-green
16	Danzig Cordial Drops	19	½ gal.	3½	1	5¾	"
15*	Berlin Double Bitters	19	10 oz.	3¾	¾	5¼	brown
17*	Elixir de Spaa	19	10 "	3¾	½	6	green-yellow
38	Greek Bitters	19	½ gal.	3½	1½	5¼	green
18*	Kontuszowka (Polish Bitters)	19	10 oz.	3¾	1	5½	red-brown
39	Krambambuli	21	½ gal.	3½	1½	5¼	"
19*	White Stomach Water	22	10 oz.	3¾	2	4½	colorless

V. Bitter Liqueurs with Extractive Taste

The liquors of this group are in general manufactured by percolation and direct extraction of drugs; in some cases these extracts are fortified with volatile oils.

The following formulas are all calculated on the basis of 10 lb. of drugs, and with a final yield of 20 lb. of essence, but the quantity of the essence to be used varies between 1 and 2 oz. per gallon.

General Method for Extracting Drugs (Method A)

Macerate 10 lb. of the well-ground and mixed drugs in a percolator with the following medium:

Alcohol	1 gal.
Water	1 "
Wine Brandy	1 pint

This last is added for refining purposes. Allow to stand for 3 days, and afterwards collect, observing the rules of percolation with the necessary further pouring on of sufficient water, $1\frac{3}{4}$ gallon first percolate. Set this aside, and then pour more water over the drugs until 1 gallon of after-percolate is obtained, which is placed in a still, and rectified to a yield of about $\frac{1}{2}$ gallon.

The first percolate and the distilled rectificate of the after-percolate are then mixed, and if their weight does not reach 20 lb., make up to this weight with alcohol.

Distil off the alcohol remaining in the drugs and use it for a similar maceration. It is often possible to avoid this redistilling of the alcohol when only the first percolate — $1\frac{3}{4}$ gallons — is collected, and the total remainder then placed with sufficient water in a still and distilled off. The distillate will be cloudy, and will contain undissolved oils, and it is necessary to dilute it to about 17 to 20° underproof and to filter by means of infusorial earth. The clear filtrate is now rectified, and the percolate and this rectificate are united, and if necessary made up with alcohol to the final weight of 20 lb.

When only small quantities of drugs are percolated, it suffices to obtain only one percolate of 20 lb. from each 10 lb. drugs.

Extraction Method with Part Employment of Volatile Oils

The Solution of the Volatile Oils. (*Method B*)

The volatile oils which are to be used to fortify or else flavor the essence must be brought into a soluble, non-clouding form,

named "*oil-spirit*" or "*esprit.*" The quantities in the formulas are calculated as in Method A for 10 lb. drugs, which yield in every case 20 lb. essence. The necessary volatile oils are dissolved in ½ gallon alcohol, and distilled with 1 gallon of water with return of distillate. Afterwards distil off 1 gallon, and filter clear by means of infusorial earth to remove the last traces of terpenes. This solution can be added to any percolate, or employed as in Method C, below.

Extraction with Employment of Oil-Spirit (Method C)

Oil-Spirit	1 gal.
Alcohol	½ "
Water	½ "
Wine Brandy (as refinement)	1 pint

With this percolate, according to Method A, 10 lb. of drugs to the final yield of 20 lb. of essence.

Compound Liqueur Oils for Bitters

Except oil of wormwood, volatile oils have no pronounced bitter taste, and the employment of compound liqueur oils is limited to their use as aromatic fortifiers of extracts from bitter drugs. Employ them as described under Method B. Colorless preparations are to be manufactured from such compound oils according to the formulas for aromatic waters.

With regard to the kinds of *bitters*, these are distinguished according to their aromatic taste. The light bitter essences of which the aromatic taste is predominant are called *Aromatic Bitters*, as against the *Strong Bitters* with a specific bitter, but little aromatic, taste. Between these are the so-called Stomach Bitters, in which both tastes are well proportioned.

(a). Aromatic Bitters Essences

Percolation without Volatile Oils. (Method A)

1. Altvater Liqueur Essence
(Austrian)
(2 oz. per gallon)

Orris Root	2 oz.
Hyssop Herb	2 "
Iva Herb	1½ lb.
Angelica Root	1½ "
Orange Flowers	1½ "
Curaçao Peel	2½ "
Angelica Seed	2¾ "
	10 lb.

2. Angelica Essence
(2 oz. per gallon)

Anise	¼ lb.
Fennel	½ "
Coriander	½ "
Bitter Orange Fruit	½ "
Angelica Seed	1¼ "
Angelica Root	7 "
	10 lb.

3. Aromatique Essence
(Thuringian specialty)
(2 oz. per gallon)

Mace	3	oz.
Cardamom	3	"
Cloves	4	"
Cubebs	4	"
Laurel Berries	4	"
Peppermint Leaves	6	"
Angelica Root	6	"
Gentian Root	6	"
Balm Leaves	6	"
Zedoary Root	7	"
Allspice	7	"
Cinnamon Flowers	8	"
Ginger	10	"
Cassia Cinnamon	10	"
Calamus Root	12	"
Roman Chamomile	1	lb.
Curaçao Peel	1½	"
Galanga Root	1½	"
	10	lb.

4. Carlsbad Bitters Essence
(1 oz. per gallon)

Nutmeg	1	oz.
Cardamom	2	"
Mace	4	"
Lemon Peel	5	"
Galanga Root	6	"
Elecampane Root	6	"
Cloves	6	"
Allspice	6	"
Cinnamon Flower	8	"
Wormwood Leaves	10	"
Centaury Herb	10	"
Cassia Cinnamon	12	"
Tansy Flowers	1	lb.
Angelica Root	1	"
Gentian Root	1½	"
Sweet Orange Peel	1¾	"

5. Convent Bitters Essence
(1 oz. per gallon)

Cardamom	4	oz.
Mace	8	"
Cassia Cinnamom	12	oz.
Cloves	12	"
Gentian Root	1	lb.
Calamus Root	1	"
Bitter Orange Peel	1	"
Lemon Peel	1	"
Balm Leaves	1½	"
Peppermint Leaves	2½	"
	10	lb.

6. Half om Half Essence
(Dutch Specialty)
(2 oz. per gallon)

Cardamom	4	oz.
Cinnamon	4	"
Angostura Bark	4	"
Curaçao Peel	1½	lb.
Sweet Orange Peel	7¾	"
	10	lb.

7. Hartz Bitters Essence
(2 oz. per gallon)

Nutmeg	3	oz.
Ginger	5	"
Cinnamon	8	"
Cloves	8	"
Cascarilla Bark	1	lb.
Gentian Root	1½	"
Bitter Orange Fruits	2	"
Calamus Root	4	"
	10	lb.

8. Hunt Bitters Essence
(1 oz. per gallon)

Mace	4	oz.
Cinnamon	4	"
Tonka Beans	8	"
Calamus Root	8	"
Star Anise	1	lb.
Peppermint Leaves	7½	"
	10	lb.

9. Italian Bitters Essence

(2 oz. per gallon)

Rosemary Leaves	2	oz.
Thyme	5	"
Sage	5	"
Majoram	5	"
Cloves	7	"
Cinnamon	8	"
Orris Root	12	"
Wormwood Leaves	12	"
Fennel	12	"
Calamus Root	12	"
Anise	12	"
Buckbean Leaves	1	lb.
Angelica Root	1	"
Lemon Peel	1	"
Bitter Orange Peel	1¼	"
	10	lb.

10. Iva Bitters Essence

(2 oz. per gallon)

Mace	½	oz.
Cardamom	½	"
Coriander	2	"
Calamus	2	"
Angelica Seed	3	"
Balm Herb	3	"
Angelica Root	4	"
Gentian Root	5	"
Iva Herb	8¾	lb.
	10	lb.

11. Kischineff Essence

(Russian Specialty)

(2 oz. per gallon)

Mace	3	oz.
Ginger	3	"
Anise	6	"
Cloves	8	"
Balm Leaves	12	"
Calamus Root	1	lb.
Hop Flower	1	"
Angelica Root	1	lb.
Cassia Cinnamon	1½	"
Curaçao Peel	3½	"
	10	lb.

12. Malakoff Essence

(2 oz. per gallon)

Capsicum Fruit	2	oz.
Fennel	2	"
Elecampane Root	2½	"
Valerian Root	2½	"
Anise	2½	"
Cascarilla Bark	3½	"
Angelica Root	7	"
Cloves	7	"
Common Yarrow Leaves	8	"
Bitter Orange Peel	8	"
Roman Chamomile Flowers	8	"
Holy Thistle Herb	10	"
Cinnamon Flowers	12	"
Wormwood Leaves	14	"
Curaçao Peels	15	"
Gentian Root	1	lb.
Peppermint Leaves	1¼	"
Calamus Root	1¼	"
	10	lb.

13. Mogadore Essence

(2 oz. per gallon)

Nutmeg	2	oz.
Cardamom	2	"
Allspice	6	"
Holy Thistle	6	"
Pyrethrum Root	8	"
Gentian Root	8	"
Valerian Root	8	"
Calamus Root	8	"
Wormwood	8	"
Cloves	8	"
Cinnamon Flowers	8	"
Balm Leaves	1	lb.
Lemon Peel	2¼	"
Bitter Orange Peel	2¼	"
	10	lb.

14. Royal Bitters Essence

(2 oz. per gallon)

Fennel	6	oz.
Coriander	6	"
Cloves	6	"
Cassia Cinnamon	6	"
Bitter Orange Peel	1¼	lb.
Lemon Peel	1¼	"
Calisaya Bark	1½	"
Peppermint	2	"
Balm Leaves	2½	"
	10	lb.

15. Sarepta Essence

(1½ oz. per gallon)

Pyrethrum Root	4	oz.
Sage Muscade	5	"
Laurel Berries	5	"
Cinnamon	5	"
Black Mustard Seed	5	"
Gentian Root	8	"
Paradise Grains	12	"
Cubebs	1¼	lb.
Lovage Root	2½	"
Galanga Root	3½	"
	10	lb.

16. Stonsdorf Bitter

(2 oz. per gallon)

Cloves	3	oz.
Angelica Root	3	"
Gentian Root	4	oz.
Wormwood Leaves	4	"
Galanga Root	4	"
Zedoary Root	6	"
Coriander	8	"
Calisaya Bark	8	"
Curaçao Peel	8	"
Bitter Orange Fruit	8	"
Star Anise	1	lb.
Carob	1½	"
Anise	1½	"
Black Bilberries	2½	"
	10	lb.

17. Usquebaugh Essence

(Scotch Specialty)

(2 oz. per gallon)

Nutmeg	4	oz.
Mace	4	"
Coriander	6	"
Cassia Cinnamon	6	"
Orris Root	8	"
Calamus Root	8	"
Anise	8	"
Angelica Root	8	"
Juniper Berries	12	"
Balm Leaves	1	lb.
Bitter Orange Fruit	1	"
Bitter Almonds	1	"
Lemon Peel	3	"
	10	lb.

Percolation with Addition of Volatile Oils (Method C)

18. Benedictine Essence

(1 oz. per gallon)

Oil-Spirit from

Oil of Coriander	1	oz.
" " Cardamom	1	"
" " Galanga	2	"
" " Peppermint	2	"
" " Wormwood	3½	"
" " Lemon	4	"

Vegetables:

Tonka Beans	2	oz.
Calamus Root	3	"
Thyme Herb	3	oz.
Cinnamon	4	"
Mace	4	"
Cloves	4	"
Arnica Flowers	6	"
Angelica Root	6	"
Amber Grains	½	lb
Angelica Seeds	½	"
Peppermint	1½	"
Hyssop Leaves	1½	"
Wormwood Herb	1½	"
Balm Leaves	2¾	"
	10	lb.

19. Carpathian Bitters Essence

(Hungarian Specialty)

(1½ oz. per gallon)

Oil-Spirit from

Oil of Mace	⅛	oz.
" " Curaçao	2	"
" " Bitter Orange	2	"
" " Wormwood	2	"
" " Calamus	3	"

Vegetables:

Cinnamon	3	oz.
Cloves	5	"
Gentian Root	1	lb.
Curaçao Peel	1¼	"
Holy Thistle	1¼	"
Calamus Root	1½	"
Buckbean Leaves	1½	"
Bitter Orange Peel	1½	"
Wormwood Herb	1½	"
	10	lb.

20. Chartreuse Essence

(1 oz. per gallon)

Oil-Spirit from

Oil of Lemon	½	oz.
" " Balm	½	"
" " Wormwood	½	"
" " Hyssop	½	"
" " Angelica	1	"
" " Coriander	1	"

Vegetables:

Mace	2	oz.
Cloves	2	"
Cinnamon	3	"
Cardamom	3	"
Paradise Grains	4	"
Star Anise	5	"
Angelica Root	5	"
Calisaya Bark	8	"
Wormwood	8	"
Balm Herb	12	"
Ginger	12	"
Calamus Root	1	lb.
Iva Herb	1¼	lb.
Angelica Seed	1¼	"
Coriander	2½	"
	10	lb.

21. English Bitters Essence

(1 oz. per gallon)

Oil-Spirit from

Oil of Celery	2	oz.
" " Rosemary	2	"
" " Lavender	2	"

Vegetables:

Thyme Herb	3	oz.
Centaury Herb	6	"
Buckbean Leaves	6	"
Angelica Root	6	"
Cubebs	9	"
Wormwood	9	"
Common Yarrow Flowers	9	"
Cloves	1	lb.
Cassia Cinnamon	2	"
Anise	2	"
Calamus Root	2	"
	10	lb.

22. Fine Bitters Essence

(1 oz. per gallon)

Oil-Spirit from

Oil of Neroli	⅛	dr.
" " Bitter Orange	1	oz.
" " Lemon	1	"
" " Wormwood	1	"
" " Angelica	1	"
" " Cinnamon	1	"

Vegetables:

Wormwood Herb	½	lb.
Holy Thistle	½	"
Juniper Berries	½	"
Pyrethrum Root	½	"
Angelica Root	1	"
Buckbean Leaves	1	"
Cloves	1	"
Roman Chamomiles	1	"
Lemon Peel	2	"
Bitter Orange Peel	2	"
	10	lb.

23. Moreau Bitters Essence

(1 oz. per gallon)

Oil-Spirit from

Oil of Cardamom	½ dr.
" " Horsemint	½ "
" " Wormwood	2 "
" " Cassia Cinnamon	3 "
" " Mace	5 "
" " Calamus	6 "
" " Angelica	6 "
" " Cloves	7 "
" " Anise	1½ oz.
" " Lemon	2 "
" " Bitter Orange	2 "

Vegetables:

Nutmeg	8 oz.
Cloves	8 "
Galanga Root	1½ lb.
Bitter Orange Peel	1¾ "
Quassia Wood	3 "
Bitter Orange Fruit	3 "
	10 lb.

24. Spanish Bitters Essence

(1 oz. per gallon)

Oil-Spirit from

Oil of Roman Chamomiles	⅛ dr.
" " Cassia Cinnamon	1 oz.
" " Wormwood	1 "
" " Angelica	1 "
" " Cloves	1½ "
" " Juniper	2 "
" " Balm	2½ "
" " Calamus	5 "
" " Bitter Orange	5 "

Vegetables:

Marjoram Leaves	2 oz.
Cloves	3 "
Roman Chamomiles	3 "
Elecampane Root	5 "
Allspice	5 "
Zedoary Root	5 oz.
Coriander	5 "
Juniper Berries	5 "
Peppermint Leaves	6 "
Buckbean Leaves	6 "
Cascarilla Bark	6 "
Gentian Root	9 "
Wormwood Herb	10 "
Angelica Root	10 "
Centaury Herb	10 "
Galanga Root	14 "
Calamus Root	1 lb.
Bitter Orange Peels	1 "
" " Fruits	1½ "
	10 lb.

25. Spice Bitter Essence

(1 oz. per gallon)

Oil-Spirit from

Oil of Petit Grain	½ oz.
" " Allspice	½ "
" " Cassia Cinnamon	½ "
" " Pepper	1 "
" " Lovage Root	1 "
" " Common Yarrow	1 "
" " Bitter Orange	1½ "
" " Sweet Orange	3½ "

Vegetables:

Anise	2 oz.
Gentian Root	2 "
Angelica Root	3 "
Mace	3 "
Peppermint Leaves	6 "
Coriander	½ lb.
Galanga Root	½ "
Allspice	½ "
Cloves	1 "
Calamus Root	1½ "
Ginger	1½ "
Lemon Peel	1½ "
Bitter Orange Peel	2 "
	10 lb.

(*b*) *Stomach Bitters*

Percolation without Essential Oils (*Method A*)

26. Aquavita Essence
(1 oz. per gallon)

Cloves	1	oz.
Nutmeg	1	"
Cinnamon	2	"
Gentian Root	8	"
Angelica Root	10	"
Galanga Root	10	"
Centaury Herb	1	lb.
Buckbean Leaves	1	"
Zedoary Root	1	"
Wormwood	1	"
Holy Thistle Herb	1	"
Lemon Peel	1½	"
Bitter Orange Peel	1½	"
	10	lb.

27. Boonecamp of Maagbitters
(Dutch Specialty)
(2 oz. per gallon)

Saffron	2	oz.
Cloves	3	"
Angelica Root	3	"
Gentian Root	4	"
Wormwood Herb	4	"
Galanga Root	4	"
Coriander	4	"
Calisaya Bark	8	"
Calamus Root	8	"
Zedoary Root	8	"
Bitter Orange Peel	12	"
Guaiac Wood	12	"
Bitter Orange Fruits	12	"
Manna	12	"
Star Anise	1	lb.
Licorice Root	1½	"
Carob	1½	"
	10	lb.

28. Carminative Bitters Essence
(2 oz. per gallon)

Cardamom	¼	lb.
Cloves	¼	"
Cubebs	½	lb.
Cinnamon	1	"
Galanga Root	1¼	"
Orris Root	1¼	"
Ginger	1¼	"
Calamus Root	1¼	"
Bitter Orange Fruits	3	"
	10	lb.

29. Cholera Bitters Essence
(2 oz. per gallon.)

Cinnamon Bark	¼	lb.
Angelica Root	½	"
Gentian Root	¾	"
Zedoary Root	1	"
Centaury Herb	1	"
Galanga Root	1	"
Buckbean Leaves	1	"
Peppermint Leaves	1½	"
Bitter Orange Fruit	3	"
	10	lb.

30. Doctor Bitters Essence
(2 oz. per gallon)

Cardamom	2½	oz.
Galanga Root	2½	"
Paradise Grains	3	"
Cinnamon Flowers	4	"
Coriander	4	"
Cinnamon	4	"
Cloves	4	"
Angelica Root	4	"
Nutmeg	4	"
Quassia Wood	6	"
Mace	6	"
Wormwood	6	"
Gentian Root	6	"
White Cinnamon	6	"
Bitter Orange Fruit	6	"
Bilberries	12	"
Allspice	8	"
Lemon Peel	12	"
Curaçao Peel	1½	"
Bitter Orange Peel	2¼	"
	10	lb

31. Electoral Stomach Bitters Essence (Danzig Specialty)

(2 oz. per gallon)

Elecampane Root	¼	lb.
Iva Herb	¾	"
Gentian Root	1	"
Cinnamon	1¼	"
Cloves	1¼	"
Curaçao Peel	2½	"
Bitter Orange Fruit	3	"
	10	lb.

32. Fernet Branca Essence (Milan Specialty)

(2 oz. per gallon)

Cardamom	3	oz.
Lemon Peel	5	"
Iva Herb	8	"
Curaçao Peel	10	"
Calisaya Bark	10	"
Angelica Root	12	"
Orris Root	1	lb.
Wormwood Herb	1¼	"
Calamus Root	1¼	"
Bitter Orange Peel	1½	"
Gentian Root	2	"
	10	lb.

33. Gruiten Absynth Bitters (Dutch Specialty)

(2 oz. per gallon)

Coriander Seed	¼	lb.
Angelica Root	½	"
Wormwood	1	"
Gentian Root	1	"
Calamus Root	7¼	"
	10	lb.

34. Ingredient Stomach Bitters

(2 oz. per gallon)

Cinnamon Flower	4	oz.
Cloves	4	"
Allspice	5	"
Roman Chamomiles	5	"
Centaury Herb	6	"
Valerian Root	6	"
Wormwood Herb	6	oz.
Galanga Root	6	"
Gentian Root	6	"
Pyrethrum Root	½	lb.
Cinnamon	½	"
Calisaya Bark	½	"
Angelica Root	¾	"
Balm Leaves	¾	"
Lemon Peel	1½	"
Bitter Orange Peel	2½	"
	10	lb.

35. Kujawian Stomach Drops Essence

(2 oz. per gallon)

Tonka Beans	2	oz.
Mace	4	"
Paradise Grains	4	"
Cassia Cinnamon	6	"
Allspice	8	"
Galanga Root	1	lb.
Gentian Root	1½	"
Bitter Orange Peel	1½	"
Bitter Orange Fruit	1½	"
Cloves	1½	"
Ginger	1½	"
	10	lb.

36. Malta Knights' Bitters Essence

(2 oz. per gallon)

Tonka Beans	¼	lb.
Sage Leaves	¼	"
Marjoram Herb	¼	"
Calamus Root	½	"
Ginger	½	"
Elder Flower	½	"
Buckbean Herb	½	"
Angelica Root	½	"
Cassia Cinnamon	1	"
Anise	1	"
Zedoary Root	1	"
Cloves	1¼	"
Galanga Root	1¼	"
Gentian Root	1¼	"
	10	lb.

37. Muscade Bitters Essence

(2 oz. per gallon)

Arnica Flowers	¼	lb.
Ginger	½	"
Angostura Bark	½	"
Cloves	½	"
Common Yarrow Flowers	½	"
Iva Herb	¾	"
Mace	1¼	"
Bitter Orange Fruit	1¼	"
Calamus Root	1½	"
Centaury Herb	3	"
	10	lb.

38. Old Swedish Essence

(2 oz. per gallon)

Remark: The original formulas contain a large amount of aloes and agaric, but because of their injurious effect these ingredients are here omitted.

Cloves	3	oz.
Galanga Root	7	"
Zedoary Root	10	"
Star Anise	10	"
Cassia Cinnamon	10	"
Lemon Peel	12	"
Coriander Seed	12	"
Gentian Root	1¾	lb.
Bitter Orange Fruit	1¾	"
Bitter Orange Peel	2½	"
	10	lb.

39. Tonic Stomach Bitters Essence

(2 oz. per gallon)

Elecampane Root	1	lb.
Centaury Herb	1½	"
Holy Thistle Herb	1½	"
Buckbean Leaves	1½	"
Galanga Root	2	"
Gentian Root	2½	"
	10	lb.

Percolation with Addition of Volatile Oils (Method C)

40. Universal Bitters Essence

(2 oz. per gallon)

Nutmeg	2	oz.
Coriander Seed	2	"
Wormwood	2	"
Calamus Root	2	"
Cassia Cinnamon	4	"
Fennel Seed	4	"
Angelica Root	4	"
Cinnamon Flowers	4	"
Bitter Orange Peel	4	"
Cardamom	4	"
Gentian Root	5	"
Bilberries	5	"
Bitter Orange Fruits	6	"
Star Anise	8	"
Cubebs	8	"
Zedoary Root	8	"
Cassia Cinnamon	8	"
Cloves	1	lb.
Curaçao Peel	1	"
Ginger	1	oz.
Carob	1	"
Calanga	1	"
	10	lb.

41. Alpine Herbs Bitters Essence

(2 oz. per gallon)

Oil-Spirit from:

Oil of Cloves	3	dr.
" " Mace	5	"
" " Wormwood	5	"
" " Coriander	5	"
" " Angelica	5	"
" " Peppermint	5	"
" " Cinnamon	6	"
" " Calamus	8	"
" " Lemon	4	oz.
" " Sweet Orange	4	"
" " Bitter Orange	5	"

Vegetables:

Coriander	5 oz.
Calamus Root	15 "
Wormwood Herb	15 "
Marjoram Leaves	15 "
Thyme Herb	15 "
Juniper Berries	15 "
Peppermint Leaves	1½ "
Angelica Root	1½ "
Bitter Orange Peel	2 "
	10 lb.

42. BAVARIAN HERBS STOMACH BITTERS ESSENCE

(Graefenhan Type)

(2 oz. per gallon)

Oil-Spirit from:

Oil of Cloves	1½ dr.
" " Mace	3 "
" " Valerian Root	6 "
" " Fennel	9 "
" " Lemon	2 oz.
" " Angelica	2 "
" " Cinnamon	4 "
" " Sweet Orange	4 "

Vegetables:

Cardamom	3 oz.
Anise	3 "
Caraway	5 "
Cassia Cinnamon	5 "
Cloves	5 "
Coriander	5 "
Mace	6 "
Calamus Root	1 lb.
Sweet Orange Peel	1¼ "
Bitter " "	1¼ "
Angelica Root	1¼ "
Gentian Root	3¼ "
	10 lb.

43. DUTCH STOMACH BITTERS ESSENCE

Oil-Spirit:

Oil of Angelica	½ oz.
" " Allspice	2 "
" " Sweet Orange	3½ "

Vegetables:

Bitter Orange Fruit	1½ lb.
Zedoary Root	2½ "
Bitter Orange Peel	2½ "
Gentian Root	3½ "
	10 lb.

44. STOMACH BITTERS ESSENCE

(2 oz. per gallon)

Oil-Spirit from:

Oil of Bitter Orange	1 oz.
" " Lemon	1½ "
" " Sweet Orange	2½ "

Vegetables:

Cloves	¼ lb.
Holy Thistle	¾ "
Pyrethrum Root	1 "
Buckbean Herb	1 "
Bitter Orange Peel	2 "
Lemon Peel	2¼ "
Gentian Root	2¾ "
	10 lb.

45. SWISS HERB STOMACHIC BITTERS ESSENCE

(2 oz. per gallon)

Oil-Spirit from:

Oil of Juniper	6 dr.
" " Cloves	9 "
" " Cinnamon	9 "
" " Wormwood	1 oz.
" " Sweet Orange	1 "
" " Lemon	1 "
" " Calamus	2¼ "

Vegetables:

Paradise Grains	3 oz.
Angelica Seed	4 "
Angelica Root	6 "
Calisaya Bark	6 "
Ginger	8 "
Guaiac Wood	9 "
Balm Leaves	12 "
Valerian Root	1 lb.
Calamus Root	1 "
Wormwood	1½ "
Lemon Peel	1¾ "
Bitter Orange Peel	1¾ "
	10 lb.

(c) *Strong Bitters*

Percolation without Volatile Oils (Method A)

46. Angostura Essence

(2 oz. per gallon)

Galanga Root	4	oz.
Zedoary Root	4	"
Carob	½	lb.
Cardamom	½	"
Ginger	½	"
Calisaya Bark	½	"
Lemon Peel	½	"
Cloves	¾	"
Bitter Orange Fruit	1	"
Tonka Beans	1	"
Cinnamon Bark	1	"
Bitter Orange Peel	1	"
Angostura Bark	2¼	"
	10	lb.

47. Beer Bitters Essence

(Bitters Extract)

(2 oz. per gallon)

Cloves	½	lb.
Cascarilla Bark	½	"
Cassia Cinnamon	½	"
Quassia Wood	¾	"
Bitter Orange Peel	¾	"
Bitter Orange Fruit	¾	"
Galanga Root	1	"
Chiretta Herb	1	"
Wormwood	1¼	"
Holy Thistle Herb	1½	"
Buckbean Leaves	1½	"
	10	lb.

48. Capuchin Liqueur Essence

(2 oz. per gallon)

Cardamom	2	oz.
Sassafras Wood	4	"
Cloves	5	"
Valerian Root	5	"
Ginger	½	lb.
Zedoary Root	½	"
Galanga Root	¾	"
Angelica Root	¾	"
Star Anise	¾	"
Buckbean Leaves	1¼	"
Curaçao Peel	1½	"
Gentian Root	3	"
	10	lb.

49. Daubitz Essence

(2 oz. per gallon)

Anise	½	lb.
Fennel	½	"
Cloves	1	"
Cinnamon	1½	"
Peppermint	1½	"
Angelica Root	1½	"
Galanga Root	1½	"
Gentian Root	2	"
	10	lb.

50. Elixir ad Longam Vitam Essence (Elixir of Long Life)

(2 oz. per gallon)

Saffron	2	oz.
Cassia Cinnamon	4	"
Cloves	6	"
Myrrh	7	"
Nutmeg	7	"
Anise	10	"
Zedoary Root	1¼	lb.
Bitter Orange	1½	"
" " Fruit	1½	"
Galanga Root	1½	"
Gentian Root	2	"
	10	lb.

51. Hamburg Bitters Essence

(1 oz. per gallon)

Black Pepper	½	oz.
Cardamom	3½	"
Nutmeg	4	"
Cloves	8	"
Laurel Berries	8	"
Zedoary Root	8	"
Ginger	8	"
Gentian Root	12	"
Cassia Cinnamon	12	"
Bitter Orange Fruits	12	"
Buckbean Leaves	1¼	"
Centaury Herb	1¼	"
Galanga Root	2¾	"
	10	lb.

52. Helgoland Bitters Essence

(2 oz. per gallon)

Quassia Wood	2	oz.
Cardamom	3	"
Valerian Root	3	"
Laurel Berries	4	"
Calamus Root	4	"
Centaury Herb	½	lb.
Cloves	½	"
Cassia Cinnamon	½	"
Anise	½	"
Zedoary Root	1	"
Galanga Root	1	"
Bitter Orange Peel	2	"
Gentian Root	3	"
	10	lb.

53. Hop Bitters Essence

(2 oz. per gallon)

Wormwood	½	lb.
Centaury Herb	1	"
Gentian Root	1	"
Hops	7½	"
	10	lb.

54. Indian Bitters Essence

(2 oz. per gallon)

Centaury Herb	½	lb.
Curaçao Peel	¾	"
Chiretta Herb, Indian	8¾	"
	10	lb.

55. Ivan Bitters Essence

(Russian Specialty)

(2 oz. per gallon)

Nutmeg	4	oz.
Allspice	4	"
Ginger	8	"
Juniper Berries	10	"
Angelica Seed	10	"
Cassia Cinnamon	10	"
Cloves	12	"
Galanga Root	14	"
Bitter Orange Fruit	1¼	lb.
" " Peel	1½	"
Gentian Root	2½	"
	10	lb.

56. Nelson Bitters Essence

(1 oz. per gallon)

Bitter Orange Fruit	1	lb.
Calamus Root	2	"
Zedoary Root	2	"
Galanga Root	2	"
Gentian Root	3	"
	10	lb.

57. Podbipiéta Essence (Polish Horsemen Liqueur)

(2 oz. per gallon)

Cloves	3	oz.
Cinnamon Bark	5	"
Coriander	5	"
Quassia Wood	5	"
Peppermint Leaves	10	"
Horsemint Leaves	10	"
Wormwood Herb	10	"
Gentian Root	1	lb.
Fennel	1	"
Anise	1	"
Bitter Orange Peel	4	"
	10	lb.

58. Polish Bitters Essence

(1 oz. per gallon)

Coriander	2	oz.
Cloves	4	"
Cassia Cinnamon	4	"
Quassia Wood	8	"
Elecampane Root	10	"
Wormwood Herb	1	lb.
Orris Root	1	"
Fennel	1¼	"
Anise	1¼	"
Horsemint Leaves	1½	"
Gentian Root	2¼	"
	10	lb.

59. Calisaya Bitters Essence

(Fever Drops Essence)

(1 oz. per gallon)

Bitter Orange Peel	3	oz.
Ginger	3	"
Galanga Root	6	"
Gentian Root	12	"
Calisaya Bark	8½	lb.
	10	lb.

60. Root Bitters Essence

(2 oz. per gallon)

Rhubarb Root	½	lb.
Galanga Root	1	"
Ginger	1	"
Angelica Root	1	"
Zedoary Root	1½	"
Calamus Root	2	"
Gentian Root	3	"
	10	lb.

61. Seamens Bitters Essence

(2 oz. per gallon)

Cardamom	3	oz.
Nutmeg	5	"
Coriander	8	"
Cinnamon	½	lb.
Cloves	½	"
Allspice	½	"
Caraway	½	"
Calisaya Bark	1	"
Angelica Root	1¼	"
Galanga Root	1¼	"
Gentian Root	1¼	"
Calamus Root	2¼	"
	10	lb.

62. Samaritan Bitters Essence

(3 oz. per gallon)

Calamus Root	6	oz.
Wormwood Herb	6	"
Laurel Berries	6	"
Orris Root	6	"
Zedoary Root	6	"
Cloves	6	"
Nutmeg	8	"
Gentian Root	12	"
Lemon Peel	12	"
Angelica Root	12	"
Cassia Cinnamon	1	lb.
Curaçao Peel	2	"
Calisaya Bark	2	"
	10	lb.

Percolates with Addition of Volatile Oils (Method C)

63. Black Bitters Essence

(2 oz. per gallon)

Oil-Spirit from:

Oil of Fennel	1	oz.
" " Galanga	1½	"
" " Sweet Orange	2	"
" " Bitter Orange	5	"

Vegetables:

Gentian Root	½	oz.
Fennel	1	"
Galanga Root	1	"
Bitter Orange Peel	1	"
Elecampane Root	1½	"
Bitter Orange Fruit	5	"
	10	lb.

64. Giant Bitters Essence

(2 oz. per gallon)

Oil-Spirit from:

Oil of Cardamom	1½	dr.
“ “ Coriander	1½	“
“ “ Calamus	1½	“
“ “ Cloves	6	“
“ “ Cinnamon	7	“
“ “ Mace	1	“
“ “ Bitter Orange	7	“

Vegetables:

Cloves	1	oz.
Elecampane Root	1	“
Orris Root	2	“
Capsicum Fruit	2	“
Cinnamon Flowers	2	“
Laurel Berries	3	“
Nutmeg	3	“
Ginger	3	“
Holy Thistle Herb	5	“
Galanga Root	10	“
Sweet Orange Peel	1	lb.
Lemon Peel	1	“
Wormwood Herb	1	“
Buckbean Herb	1	“
Angelica Root	1¼	“
Gentian Root	1¼	“
Calisaya Bark	1½	“
	10	lb.

65. Green Bitters Essence

(1 oz. per gallon)

Oil-Spirit from:

Oil of Cloves	2	dr.
“ “ Cardamom	2	“
“ “ Cinnamon	2	“
“ “ Calamus	8	“
“ “ Angelica	3	“
“ “ Horsemint	3	“
“ “ Wormwood	6	“
“ “ Sweet Orange	1½	oz.

Vegetables:

Elecampane Root	4	oz.
Balm Mint Leaves	6	“
Wormwood Herb	6	“
Cloves	6	“
Cinnamon Flowers	6	“
Roman Chamomiles	7	“
Buckbean Herb	8	“
Centaury Herb	8	“
Bitter Orange Peel	13	“
Galanga Root	1¼	“
Zedoary Root	1¼	“
Calamus Root	1½	“
Gentian Root	2	“
	10	lb.

(d) *Compound Liqueur Oils for Bitters*

Employment: 1 oz. is sufficient for 1 lb. essence, of which 1 oz. is required to flavor a gallon of alcohol.

66. Compound Liqueur Oil for Aromatique Liqueur

Oil of Neroli	1	dr.
“ “ Lavender Flowers	6	“
“ “ Angelica	6	“
“ “ Wormwood	9	“
“ “ Balm	12	“
“ “ Mace	12	“
Oil of Peppermint	1	oz.
“ “ Ginger	1	“
“ “ Cloves	1½	“
“ “ Cinnamon	1½	“
“ “ Lemon	3	“
“ “ Calamus	4½	“
Benzaldehyde	10	“
	1	lb.

67. Compound Liqueur Oil for Benedictine Liqueur

Oil of Mace	½	oz.
" " Cinnamon	½	"
" " Thyme	½	"
" " Balm	1	"
" " Calamus	1¼	"
" " Angelica	2	"
" " Peppermint	2¼	"
" " Sweet Orange	2¼	"
" " Lemon	2¾	"
" " Wormwood	3	"
	1	lb.

68. Compound Liqueur Oil for Carlsbad Bitters

Oil of Sassafras	2	dr.
" " Cassia	3	"
" " Cedar Wood	3	"
" " Roman Chamomiles	6	"
" " Anise	6	"
" " Mace	6	"
" " Galanga	6	"
" " Cardamom	1	oz.
" " Coriander	1½	"
" " Cloves	1½	"
" " Cinnamon	1½	"
" " Wormwood	2½	"
" " Lemon	2½	"
" " Angelica	3½	"
	1	lb.

69. Compound Liqueur Oil for Chartreuse Liqueur

Oil of Rose	2	dr.
" " Neroli	2	"
" " Wormwood	¾	oz.
" " Mace	1	"
" " Coriander	1	"
" " Balm	1½	"
" " Cinnamon	1½	"
" " Angelica	2½	"
" " Sweet Orange	7½	"
	1	lb.

70. Compound Liqueur Oil for Cholera Bitters

Oil of Coriander	4	dr.
" " Roman Chamomiles	5	"
Oil of Lemon	5	dr.
" " Bitter Orange	6	"
" " Marjoram	6	"
" " Thyme	6	"
" " Anise	1	oz.
" " Juniper	1	"
" " Sweet Orange	2	"
" " Calamus	2	"
" " Cloves	2½	"
" " Angelica	2½	"
" " Wormwood	3	"
	1	lb.

71. Compound Liqueur Oil for Electoral Bitters

Oil of Gentian	1	oz.
" " Cubebs	1	"
" " Cinnamon	1¼	"
" " Anise	1¼	"
" " Sweet Orange	1½	"
Balsam of Peru	3	"
Oil of Elecampane	3½	"
" " Bitter Orange	3½	"
	1	lb.

72. Compound Liqueur Oil for English Bitters

Oil of Cardamom	½	oz.
" " Wormwood	½	"
" " Coriander	½	"
" " Cinnamon	½	"
" " Calamus	½	"
" " Star Anise	1	"
" " Allspice	1	"
" " Lemon	3½	"
" " Sweet Orange	8	"
	1	lb.

73. Compound Liqueur Oil for Fine Bitters

Oil of Lemon	½	oz.
" " Cloves	½	"
" " Balm	1	"
" " Chamomiles	2	"
" " Wormwood	2	"
" " Valerian	2	"
" " Galanga	2	"
" " Angelica	3	"
" " Sweet Orange	3	"
	1	lb.

74. Compound Liqueur Oil for Hunt Bitters

Oil of Cloves	½ oz.
" " Mace	1 "
" " Lemon	1 "
" " Sweet Orange	1¼ "
" " Celery	1¼ "
" " Caraway	1½ "
Benzaldehyde	1½ "
Oil of Wormwood	2 "
" " Calamus	2 "
" " Peppermint	4 "
	1 lb.

75. Compound Liqueur Oil for Spanish Bitters

Oil of Lemon	½ oz.
" " Coriander	½ "
" " Spanish Origanum	½ "
Benzaldehyde	½ "
Oil of Celery	½ "
" " Mace	1 "
" " Calamus	1 "
" " Galanga	2½ "
" " Curaçao	2½ "
" " Wormwood	6½ "
	1 lb.

76. Compound Liqueur Oil for Swiss Alpine Herbs Bitters

Oil of Peppermint	¼ oz.
" " Balm	¾ "
" " Coriander	¾ "
" " Gentian	¾ "
" " Bitter Orange	¾ "
Benzaldehyde	¾ "
Oil of Cloves	1½ "
" " Cinnamon	1½ "
" " Angelica	1½ "
" " Calamus	2½ "
" " Wormwood	5 "
	1 lb.

77. Compound Liqueur Oil for Universal Stomach Bitters

Oil of Star Anise	¾ oz.
" " Angelica	¾ "
Benzaldehyde	1 "
Oil of Cloves	2 "
" " Cinnamon	2 "
" " Calamus	4½ "
" " Wormwood	5 "
	1 lb.

Composition of Bitter Liqueurs
For 10 gallons.

Essence formula No.		Content of alcohol.	Quantity of essence.	Alcohol 38° over-proof.	Sugar syrup, 60%.	Water.	Color and other additions.
	Aromatic Bitters.	Deg.	Oz.	Gal.	Gal.	Gal.	
1	Altvater Liqueur	27	20	3	3	4¼	light-yellow
2	Angelica "	19	20	3¾	2	4½	brown
3	Aromatique "	19	20	3¾	2	4½	red-brown
66*	" "	19	10	4	2	4¼	"
18 & 67*	Benedictine Liqueur	22	10	3½	3	3¾	yellowish-green
4 & 67*	Carlsbad Bitters	27	10	3	1¼	6	light-yellow
19	Carpathian Bitters	27	10	3	1	6¼	green-yellow
20 & 69*	Chartreuse Liqueur	19	10	4	3½	2¾	"
5	Convent Bitters	22	10	3½	3½	3¼	"
21 & 72*	English Bitters	19	10	4	1½	4¾	brown
22 & 73*	Fine Bitters	24	10	3¼	1¾	5¼	"
6	Half om Half (Dutch)	21	20	3¾	2½	4	light-yellow
7	Hartz Bitters	21	20	3¾	1½	5	brown
8 & 74*	Hunt Liqueur	24	10	3¼	2	5	light-green
9	Italian Bitters	17	10	4	1¼	5	light-brown
10	Iva Bitters	24	10	3¼	2½	4½	light-green

* Manufactured from essences made from compound liqueur oils.

COMPOSITION OF BITTER LIQUEURS. — *Continued*

Essence formula No.		Content of alcohol.	Quantity of essence.	Alcohol 38° over-proof.	Sugar syrup, 60%.	Water.	Color and other additions.
		Deg.	Oz.	Gal.	Gal.	Gal.	
	Aromatic Bitters.						
11	Kischineff Bitters.........	21	20	3¾	1½	5	dark-brown
12	Malakoff Bitters	24	20	3½	1¾	5	yellow-green
13	Mogadore Liqueur.........	19	10	4	3	3¼	brown
23	Moreau "	19	10	4	3	3¼	red-brown
14	Royal Bitters	25	20	3¼	2	5	brown
15	Sarepta Liqueur...........	15	10	4¼	....	6	light-yellow
24 & 75*	Spanish Bitters............	19	10	4	1½	4¾	brown
25	Spice Bitters..............	19	10	4	1¼	5	yellow
26	Stonsdorf Bitters..........	19	20	3¾	1	5	½ gal. Bilberry juice
17	Usquebaugh.............	21	20	3¼	2	5	light-red
	Stomachic Bitters.						
41	Alpine Herbs Bitters	19	20	3¾	1	5½	brown-green
26	Aquavit..................	19	10	4	¾	5½	yellow
42	Bavarian Bitters......	19	20	3¾	1½	5	brown-green
27	Boonecamp of Maagbitters	15	20	4¼	.....	6	brown
28	Carminativ Liqueur.....	19	20	3¾	2	4½	red-brown
29	Cholera Bitters...........	17	20	4	.....	6¼	"
70*	Cholera Bitters...........	17	10	4¼	.....	6	"
30	Doctor Bitters...........	17	10	4¼	1½	4½	"
43	Dutch Bitters............	17	10	4¼	1¼	4¾	brown
31	Electoral Stomachic.....	19	20	3¾	2	4½	yellow
71*	" "	19	10	4	2	4¼	brown
44	Estomac (French)........	17	20	3½	1¾	5	brown
32	Fernet Branca............	17	20	4	1	5¼	dark-brown
33	Gruiten Absynth Bitters..	15	20	4¼	½	5½	light-yellow
34	Ingredient Bitters..	19	20	3¾	1¼	5¼	brown
35	Kujawian Stomach Drops	15	20	4¼	.....	6	dark-brown
36	Malta Knight Bitters......	17	20	4	1½	4¾	brown
37	Muscade Bitters...........	19	20	3¾	1¼	5¼	brown-yellow
38	Old Swedish Bitters	19	20	3¾	1	5½	dark-brown
45	Swiss Alpine Herbs Bitters	19	20	3¾	1½	5	yellow-green
40	Universal Bitters..........	19	20	3¾	2½	4	red-brown
77*	" "	19	10	4	2½	3¾	"
	Strong Bitters.						
46	Angostura Bitters.... ...	19	20	3¾	1	5½	red-brown
47	Beer Bitters (Bitter Extract)	19	20	3¾	1	5½	brown-green
63	Black Bitters..	19	20	3¾	2	4½	dark-brown
48	Capuchin Bitters..........	15	20	4¼	1	5	"
49	Daubitz Bitters...........	19	20	3¾	1½	5	red-brown
50	Elixir ad Longam Vitam...	19	20	3¾	1	5½	dark-brown
64	Giant Bitters	22	20	3¾	1	5½	brown
65	Green Bitters............	29	10	2¾	½	7	yellow-green
51	Hamburg Bitters..........	19	20	3¾	2	4½	red-brown
52	Helgoland Bitters.........	17	20	4	1½	4¾	green
53	Hop Bitters..............	19	20	3¾	1½	5	yellow
54	Indian Bitters............	19	20	3¾	1½	5	brown
55	Iva Bitters...............	17	20	4	1½	4¾	dark-brown
56	Nelson Bitters............	19	10	4	1½	4¾	brown
57	Podbipiéta (Polish Horsemen Liqueur)..........	25	20	3½	1	5¾	red-brown
58	Polish Bitters............	24	10	3½	½	6¼	"
59	Calisaya Bitters..........	24	10	3½	1	5¾	"
60	Root Bitters..............	19	20	3¾	1½	5	brown
61	Samaritan Bitters.........	19	20	3¾	1	5½	"
62	Seamens Bitters.	19	20	3¾	1½	4½	"

* Manufactured from essences made from compound liqueur oils.

VI. Types and Imitations of Genuine Liquors

CORN WHISKY, ARRAC, COGNAC AND RUM

(a) *Grain Liquors*

Genuine grain liquors are manufactured by distilling the mash of grains, such as barley, rye, oats, wheat and buckwheat. The peculiar taste of grain alcohol is due to the presence of various higher homologues of alcohol, such as "fusel oils," and their varied taste is due to differences in the raw materials worked, as well as to manufacturing secrets.

In the interest of the honest liquor trade the imitation of grain liquors should not be allowed, with exception of "cutting" strong grain liquors with industrial alcohol under limited conditions, and with declaration of such "cutting." The use of fusel oil for producing an imitation of the taste, even in connection with the making of types, is to be frowned upon. However, it is usual to give the various kinds of grain liquors the types of well-known brands. There are in particular some spices for liquors, which differ according to the customs of the public in different countries. In most cases the distillers add the various spices, such as caraway, coriander, anise, fennel, etc., to the still after mashing. The following few formulas give only the composition of the volatile oils which are added after distilling the brandy:

1. Spice for Grain Alcohol
(Nordhausen Type)
(1 oz. per gallon Corn Whisky)

Cardamom	3½	oz.
Anise	1½	"
Coriander	2	"
Anise	6	"
Coriander	12	"
Curaçao Peel	15	"
Caraway	1	lb.
Carob	1¼	"
Light Dried Malt	2½	"
Oak Bark	2¾	"
	10	lb.

Percolate with 20 lb. corn spirit 12° underproof, pouring on water as usual, to obtain 15 lb. Place the residue in the still with about 6 gallons water and slowly distil off 5 lb. distillate which are to be mixed with the percolate to the final result of 20 lb.

2. Silesian Corn Whisky-Spice
(1 oz. per gallon Corn Spirit)

Oil of Caraway	12	oz.
" " Juniper	12	"
Carob Tincture	1½	"
Corn Spirit, Proof	7	"
	10	lb.

3. Westphalian Corn Whisky-Spice

(1 oz. per gallon Corn Spirit)

Oil of Mace	¼ oz.
" " Cloves	¼ "
" " Roman Chamomiles	½ "
" " Cassia Cinnamon	½ "
" " Lemon	6½ "
Ethyl Acetate	8 "
Alcohol	2 lb.
Corn Spirit, Proof	7 "
	10 lb.

4. Wheat-Corn Whisky-Spice

(1 oz. per gallon)

Oil of Star Anise	6 oz.
" " Caraway	10 "
Ethyl Acetate	1 lb.
Corn Spirit, Proof	8 "
	10 lb.

5. Compound Liqueur Oil for Table Aquavit (Hobro Type)

(¼ oz. per gallon)

Benzaldehyde	2 dr.
Oil of Cassia Cinnamon	6 "
" " Dill	½ oz.
" " Cloves	½ "
" " Coriander	1 "
" " Caraway	1 "
" " Lemon	2 "
" " Cognac	3½ "
Absolute Alcohol	7 "
	1 lb.

6. Spice for Whisky

(1 oz. per gallon Maize Brandy)

Carob Tincture	1 lb.
Malt Tincture (1 : 5)	2 "
Wine Brandy	2 "
Black Currant Distillate	2 "
Corn Spirit, Proof	3 "
	10 lb.

(b) *Rum Essences*

The employment of rum essences must be declared, even if only traces are used to fortify genuine rum. Rum essences are composed of so-called rum ether, *i.e.*, the ester formed by the action of diluted acetic acid on alcohol, with addition of rum flavor, solutions of volatile oils and various other esters and flavors.

7. Simple Rum Ether

For rum essences which require more than half an ounce to a gallon of artificial rum

The raw material consists of alcohol, which is esterified by means of acetic acid obtained from wood vinegar, and containing about 7% free acid. As catalyzer — which acts without entering into any reaction with the product itself — sulphuric acid is used, and the oxidation is effected by manganese peroxide. The acetic acid forms ethyl acetate, and, with some added starch, ethyl formate, and with sugar some sugar ether also.

The still used is provided with a layer of straw as a protection for the metal of the still. Formerly lead was used as a lining for the stills, but the lead is a very poor conductor of heat. The

copper stills are well adapted for use, but they must be quickly washed after the distillation is finished.

Firstly place in the straw-lined still $1\frac{1}{2}$ quarters wood vinegar of 7% acetic acid strength, and then introduce the following mixture:

Manganese Peroxide (85%), Granulated	$1\frac{1}{2}$ quarter
Potato Starch	11 lb.
Powdered Sugar	2 "

Then add

Alcohol	15 gal.

Close the still and set the condenser in operation. Now slowly and with great caution add $1\frac{1}{2}$ quarters sulphuric acid of ordinary strength.

The contents of the still will be warmed rapidly by action of the sulphuric acid. After half an hour, heat slowly and distil as slowly as possible. If the still is fitted with a reflux condenser, the distillation should be conducted with it for half an hour. The distillation must not in the least be hastened, because it often happens that the mash boils over. Distil off about 5 quarters of so-called *raw ether*.

The latter must be rectified, but first the still is emptied of its contents, and having due regard to the destructive action of the sulphuric acid, the still must be cleaned thoroughly. Now place the raw ether in the still and distil off slowly 1 quarter of first distillate, then interrupt the distillation. Mix the quarter of distillate received with a quarter of quite cold water. After some time a thin layer of a yellowish, oily, aldehydic fluid collects on the surface of the mixture, and this is removed, as it renders the finished product prone to sour rapidly. The balance of the liquid is again placed in the still. Now distil off about three-quarters of distillate, say about 12 gallons. This distillate make up with distilled water to the final result of 1 cwt.

The alcohol remaining in the still is distilled off, and this after-distillate is used for the next first distillation of rum ether, its alcoholic strength being made up by the addition of fresh alcohol.

8. Concentrated Rum Ether

(For highly concentrated rum essences)

Employing the process described above, carry out 2 operations for raw ether, but after manufacturing the first strictly as above,

in the second use just the same ingredients and no new alcohol, but instead the raw ether of the first distillation, of course without rectifying it, and distil off a *double concentrated* raw ether. The latter is to be rectified as above, *i.e.*, removing the aldehydes, and distilling until 3 quarters are obtained, which is not to be diluted. Therefore the concentrated rum ether is two and a half times more concentrated than the simple.

9. Rum Flavor Essence

Employment: 3 dr. per pound of Rum Essence.

This flavor will not substitute the rum flavor, but it is used to round out and develop the taste.

Oil of Lemon	2	oz.
" " Cognac, White	3	"
Vanillin Crystals	3	"
Balsam of Peru	½	lb.
Ethyl Butyrate	2½	"
Ethyl Acetate	2½	"
Alcohol	4	"
	10	lb.

The coloring of rum essences should be done only with catechu, not alone because of its color, but because it contains the necessary tannin, which aids the essence to develop a better flavor on storage. Furthermore, carob tincture is well suited to round the taste, and as every artificial essence has originally a raw taste, this is covered by adding some genuine rum. The composition of rum essences is based upon the price to be charged and the cost of the materials, and upon the latter depends the concentration of the rum ether. The formulas are limited here to 2 examples.

10. Basis for Artificial Rum

(Jamaica Type)

(½ oz. per gallon)

Catechu Tincture	1	oz.
Rum Aroma Essence	2	"
Ethyl Acetate	5	"
Carob Tincture	½	lb.
Genuine Jamaica Rum	1	"
Concentrated Rum Ether	8	"
	10	lb.

11. Basis for Artificial Rum

(Common Type)

(¾ to 1 oz. per gallon)

Catechu Tincture	1	oz.
Rum Flavor Essence	2	"
Ethyl Acetate	5	"
Carob Tincture	½	lb.
Simple Rum Ether	9	"
	10	lb.

Other desirable additions are Tea Essence (about 10%) and Saffron Tincture 1 : 10 (2%). The former is suited for the *West Indian* (*St. Croix*) *Type*, and the latter for *Antilles Type*.

12. Artificial Rum

Alcohol	4¾ gal.
Sugar Syrup (60%)	¼ "
Water	5¼ "

Add sufficient rum essence, ½ to 1 oz. (according to their expensiveness), and catechu tincture, 5 to 10 oz., or caramel.

It is necessary to round out the taste by storage to some extent. To age the artificial rum add to every gallon ½ oz. rhatany root tincture 1 : 5.

(*c*) *Arrac Essences*

To manufacture arrac essence take the same rum ether as for artificial rum, but compound the essence with the following special flavor essence:

13. Arrac Flavor Essence

(3 dr. per gallon of Arrac Essence)

Oil of Neroli	1½ dr.
" " Cinnamon	¼ oz.
" " Cognac	¼ "
Vanilla Crystals	¾ "
Ethyl Acetate	1¼ "
Wine Distillate	7½ "
	10 lb.

14. Basis of Artificial Arrac

(Batavia Type)

(½ oz. per gallon)

Arrac Flavor Essence	2 oz.
Ethyl Formate	6 "
Ethyl Nitrite	8 "
Ethyl Acetate	8 "
Genuine Arrac	1 lb.
Alcohol	1½ "
Rum Ether, Concentrated	6 "
	10 lb.

15. Basis of Artificial Arrac

(Goa Type)

(¾ to 1 oz. per gallon)

Arrac Aroma Essence	2 oz.
Ethyl Acetate	6 "
Ethyl Formate	8 "
Alcohol	8 "
Ethyl Nitrite	8 "
Simple Rum Ether	8 lb.
	10 lb.

16. Artificial Arrac

(12° underproof)

Alcohol	4¾ gal.
Sugar Syrup	1 pint
Water	5½ gal.
	10 gal.

(*d*) *Cognac* (*French Brandy*)

Cognac is considered as a beverage in which alcohol is derived from fermented wine. Wine distillate is not at all cognac, which is a beverage originally perfected by prolonged storage in casks.

This requires several years during which the brandy is aged and its bouquet improved by various ethers formed. In most cases the cognac is aged more quickly, as by the addition to fresh wine brandy of tannin, which is also contained in the wood of the oak casks, and also some flavoring substances as plums (prunes), burnt almond shells, etc. The following formulas are usual in the Charente, this district of France being the center of the French cognac industry, and producing the wines best suited for cognac manufacture.

17. Method of Manufacturing Cognac (Charente Type)

This kind contains a vegetable extract, called "*typage,*" and a syrup colored with caramel, any other color being prohibited. This is called "*syrupage.*" A mixture of both is called *Syrup Charentais.* The latter is the basis of cognac, which contains as alcohol *wine brandy* of least 19° underproof. The quality of a cognac depends upon the quality of the wine brandy, and the wines of the Charente are known as the best for making cognacs. The added ingredients do not in any way substitute the cognac flavor, but rather constitute an artificial ageing and transformation into desired standard types of original cognac.

(a) Cognac Typage

Black Ceylon Tea	5 oz.
Vanilla Beans	5 "
Stoned, Dried Plums	8 lb.
Oak Wood	10 "

Percolate after allowing to stand for 14 days with 8 gallons of proof wine distillate.

Result 6½ gallons extract, called *Typage.*

(b) Syrupage for Cognac

16½ lb. sugar are boiled with 2½ gallons water with the addition of 2½ lb. caramel.

Result 3½ gallons.

(c) Syrup Charentais for Cognac Basis

6½ gallons Typage and 3½ gallons Syrupage are mixed to the final result of 10 gallons, of which ¼ gallon is sufficient for 10 gallons cognac.

18. Composition of Cognac Using Syrup Charentais

In principle cognac is a mixture of $\frac{1}{4}$ oz. Syrup Charentais (containing the necessary typage), sugar and color, with genuine wine distillate in any strength. The lowest limit is about 19° underproof, but while on storage some loss is unavoidable, the ordinary manufacturing strength is 17° underproof. The wine distillate is here to be understood as of proof strength, or if of higher alcohol strength, it must be diluted to 17° underproof.

Pure cognac of 17° underproof consists of

Syrup Charentais	$\frac{1}{4}$ gal.
Pure Genuine Proof Wine Distillate	7 "
Distilled Water	3 "
	About 10 gal.

Of course higher degrees of alcohol are allowed, and improve the quality of cognac, but not more syrup should be taken, while it is inadvisable to alter the taste of cognac by other means or to substitute the taste of the wine brandy.

19. "Cut" Cognac

Any mixture of cognac with other kinds of alcohol must be declared as "cut," but at least one-tenth of the total alcohol content should consist of cognac or wine alcohol. In the above case, when the total alcohol is 17° underproof, $\frac{3}{4}$ gallon of genuine wine brandy would be required for 10 gallons "cut" cognac. The composition of this "cut" cognac will be as follows:

Syrup Charentais	$\frac{1}{4}$ gal.
Genuine Proof Wine Brandy	$\frac{3}{4}$ "
Alcohol	$3\frac{1}{2}$ "
Distilled Water	$5\frac{3}{4}$ "
	10 gal.

In this case the quantity of Syrup Charentais is the same as for pure cognac, because the general taste of the typage and the quantity of sugar and color would not be sufficient to be pronounced. A higher content of alcohol is allowed, but in every case the content of wine alcohol must be the tenth part of the total alcohol present.

20. Base for "Cut" Cognac

The trade allows dealing with a base which contains everything necessary for cognac, and the distiller has nothing else to do but

to mix the base with the necessary industrial alcohol and water as follows:

Genuine Proof Wine Distillate	¾ gal.
Syrup Charentais	¼ "
	1 gal.

Employment: 1 gallon of this base is to be mixed with 3½ gallons alcohol and 5¾ gallons distilled water.

21. Artificial Cognac Essence

In most countries the imitation of cognac is prohibited in the interest of the industry of genuine cognac and of wine in general. However for many other purposes, as for instance confectionery, artificial cognac essence is also used, as well as for imitations of cognac in so far as they are not prohibited for such drinks, which are indeed imitations, but which are sold under fancy names giving no intimation of the employment of cognac. The composition of such an essence is as follows:

Oil of Cognac, Rectified	¼ oz.
Vanilla Tincture	¼ "
Ethyl Nitrite	3½ "
Carob Tincture	4 "
Ethyl Acetate	8 "
Alcohol	2½ lb.
Distilled Water	2½ "
Genuine Wine Brandy	4 "
	10 lb.

Employment for Artificial Cognac (under any fancy name)

(17° alcohol underproof)

Cognac Essence	5 oz.
Alcohol	4¼ gal.
Water	6 "
	About 10 gal.

22. Egg-Cognac

This specialty contains alcohol of about 37° underproof, and should contain genuine cognac only. The cognac should in this case not be diluted with water, but be employed in the original strength of the proof wine brandy. ¼ gallon of Syrup Charentais is made up with 10 gallons wine brandy, and so used.

Sugar Syrup (60%)	4 gal.
Egg Yolks, fresh, or preserved by any means allowed	2½ "
Cognac, as above	3½ "
About	10 gal.

No artificial color is allowed.

For cheaper qualities *milk* is allowed, but must be declared. Other means of thickening the liquor are prohibited. Artificial colors, if allowed, must be declared also.

23. Egg-Cream Liqueur

(About 37° alcohol)

(Imitation Egg-Cognac)

Instead of cognac as flavor, the strong brandy made from the wine dregs is used.

Brandy from wine dregs	10 oz.
Egg Yolks	2½ gal.
Sugar Syrup (60%)	2½ "
Alcohol	2 "
Vanillin	5 dr.
Water (or Milk)	3½ gal.
	10 gal.

(*e*) *Supplement: Stomachic Wines*

Aromatic or stomachic wines, if they are labelled with the name "wine," must really contain wine. As bases for them sweet wines with a high alcohol content are used. The vegetables are extracted with wine brandy. The quantity of sugar is mostly 15%, and the total content of alcohol should be about 42° underproof; the original alcoholic content of the wine must be brought up to this amount with alcohol, or better, wine distillate. Instead of grape wine, fruit wine also is allowed, if this is declared. The sugar should be dissolved in the wine, and not in water, for the wine itself must not be diluted.

A great proportion of these aromatic and stomachic wines are used as medicaments, and for these tinctures of the ingredients are employed as additions. For kola, cinchona, ginger, etc., use the official tinctures of the drugs, say about ¼ pint to a gallon of the finished wine. The popular Wormwood Wine, "Vermouth" of Italian (*Turin*) type, is made as follows:

24. Extract of Vermouth (Wormwood Wine, Turin type)

Cardamom	½ oz.
Cinnamon	½ "
Cloves	½ "
Coriander	2 "
Fennel	2 "
Star Anise	2½ "
Peppermint	4 "
Centaury Herb	4 "
Balm Leaves	8 "
Angelica Root	8 "
Gentian Root	1 lb.
Alpine Wormwood (Genippe Herb)	7 "
	10 lb.

Percolate with

Wine Brandy	6 lb.
Alcohol	7 "
Sweet Wine	16 "

After 3 days collect as final result, and without expressing, 10 lb. extract.

Employment:

Extract as above	½ lb.
Sugar (according to the natural sweetness of the wine)	12–15 "

Dissolve in

Wine	2 gal.

Add

Alcohol	1 "
Wine	6½ "

VII. Alcoholic Hot Beverages (Grog and Punches)

Under the name of *Grog* or *Punch Extract* is to be understood mixtures of alcohol or genuine liquors or imitation of these with sugar, fruit acids, or fruit juices, wines, water and aromatic vegetable substances, intended to be drunk with hot water as grog or punch. Where genuine liquors like rum, arrac or cognac are imitated, or essences of their imitations are added, this must be declared. The quality of these extracts depends upon the cost of the constituent as wines or liquors. The extracts employed, diluted with 3 to 4 parts of hot water, have an average content of 22° underproof.

1. Spiced Flavor for Punches

(Aromatic addition for almost all kinds of hot beverages to be employed ½ to 1 oz. per gallon of the extract.)

Solution of Citric Acid (1 : 1)	¼ lb.
Tincture of Cloves	½ lb.
" " Cinnamon	¾ "
Orange Flower Water	1 "
Lemon Peel Distillate	3 "
Orange Peel "	4½ "
	10 lb.

(a) *Hot Drinks with the Taste of Genuine Liquors or Imitations*

2. Grog Extract from Genuine Arrac, Cognac or Rum

Spiced Punch Flavor	2 lb.
Genuine Arrac, Cognac or Rum	1½ gal.
Water	2 "
Alcohol	2¼ "
Sugar Syrup (60%)	4 "
	10 gal.

3. Grog Extract from Artificial Liquor Essences

Arrac or Rum Essence	1 lb.
Spiced Punch Flavor	2 "
Water	2¼ gal.
Alcohol	3¾ "
Sugar Syrup	4 "
	10 gal.

4. Punch Extract from Genuine Arrac, Cognac or Rum

Vanilla Essence	3 oz.
Solution Citric Acid (1 : 1)	3 "
Lemon Peel Distillate	1 lb.
Claret Wine	½ gal.
Alcohol	2 "
Genuine Arrac, Cognac or Rum	3½ "
Sugar Syrup (60%)	4 "
	10 gal.

5. Punch Extract from Artificial Liquor Essences

Artificial Arrac or Rum Essence	½ lb.
Pineapple Essence	½ "
Spiced Punch Flavor	½ "
Water	2 gal.
Alcohol	3¾ "
Sugar Syrup (60%)	4¼ "
	10 gal.

6. Toddy Extract from Genuine Whisky

Spiced Punch Flavor	½ lb.
Genuine Arrac	1 gal.
Water	2 "
Genuine Whisky	3¾ "
Sugar Syrup	3½ "
	10 gal.

7. Warm Corn Extract

Spiced Punch Flavor	½ lb.
Genuine Arrac	1 gal.
Sugar Syrup	1 "
Corn Spirit 27° underproof	6 "
Water	2¼ "
	10 gal.

(b) *Fruit Punch Extracts*

8. Punch Extract from Lemon, Orange and Pineapple

Pineapple Essence, or Lemon or Sweet Orange Distillate	2 lb.
Pineapple, Lemon or Sweet Orange Juice	¼ gal.
Water	1 "
Genuine Arrac	2 "
Alcohol	3 "
Sugar Syrup (60%)	4 "
	10 gal.

(*c*) *Fancy Punches*

9. COFFEE OR TEA PUNCH EXTRACT

Coffee or Tea Essence	1 lb.
Genuine Arrac	2 gal.
Water	2 "
Alcohol	2½ "
Sugar Syrup	3¾ "
	10 gal.

10. MILK PUNCH EXTRACT

Sugar	40 lb.
Fresh Milk	5 gal.

Boil to a syrup, then add

Vanilla Essence	1 oz.
Tincture of Mace	2½ "
Genuine Rum	½ gal.
Alcohol	2½ "
	10 gal.

11. ROYAL PUNCH EXTRACT

Infusion of ¼ lb. Gunpowder Tea (Green)	½ gal.
Genuine Cognac	1 pint
" Arrac	1½ "
Lemon Juice	1½ "
Sweet Orange Juice	¼ gal.
Water	1½ "
Alcohol	3½ gal.
Sugar Syrup	4 "
	10 gal.

12. RUSSIAN KASKANTSCHI PUNCH EXTRACT

Tincture of Cloves	1 oz.
" " Cinnamon	1 "
Vanilla Tincture	½ lb.
Lemon Distillate	½ "
Black Tea Infusion	1 "
Rum	¼ gal.
Alcohol	2 "
Water	2 "
Genuine Arrac	3 "
Sugar Syrup (60%)	2¾ "
	10 gal.

13. SWEDISH PUNCH (Swedish National Beverage)

Ready to drink ice-cold, and without dilution.

Lemon Juice	¼ gal.
Alcohol	1 "
Genuine Arrac	1½ "
Sugar Syrup	3½ "
Water	4 "
	10 gal.

(*d*) *Wine Punches*

The quality of wine punches depends upon the quality of the wines and liquors used. Artificial essences and volatile oils should never be employed. The color should be that natural to the wine; some colored fruit juices are also employed, not because of their darker color, but because their particular taste is wanted to complete the flavor.

14. BISHOP EXTRACT

Vanilla Tincture	½ oz.
Mace Tincture	1 "
Cardamom Tincture	1 "
Cloves Tincture	2 "
Lemon Distillate	1 lb.
Sweet Orange Distillate	1½ "
Alcohol	3 gal.
Dark Claret Wine	3 "
Sugar Syrup (60%)	4 "
	10 gal.

15. Burgundy Wine Punch Extract

Vanilla Essence	1	oz.
Lemon Juice	¼	gal.
Rum	¼	"
Arrac	½	"
Water	2¼	"
Genuine Burgundy Wine	3	"
Sugar Syrup	4	"
	10	gal.

16. Cardinal Punch Extract

Tincture of Mace	1	oz.
Cinnamon Tincture	2	"
Clove "	2	"
Lemon Distillate	1	lb.
Sweet Orange Distillate	1½	"
White Wine	3	gal.
Alcohol	3½	"
Sugar Syrup	3½	"
	10	gal.

17. Claret Punch Extract

Cardamom Tincture	1	oz.
Clove "	3	"
Cinnamon "	3	"
Lemon Juice "	1	lb.
Genuine Rum	¼	gal.
Sugar Syrup	4	"
Dark Claret Wine	4¾	"
	10	gal.

18. Glowing Wine Punch Extract

Cardamom Tincture	2	oz.
Pineapple Essence	3	"
Cinnamon Tincture	5	"
Clove Tincture	5	"
Genuine Arrac	¼	gal.
Alcohol	1½	"
Cherry Fruit Syrup	4	"
Claret Wine	4½	"
	10	gal.

19. Imperial Punch Extract

Mandarin Distillate	¼	lb.
Lemon Juice	¼	gal.
Genuine Arrac	¼	"
Sugar Syrup	4	"
White Wine	5¾	"
	10	gal.

20. White Wine Punch Extract from Mosel, Rhine or Chablis Wine

Sweet Orange Juice	½	gal.
Genuine Arrac	1	"
Sugar Syrup (60%)	3¾	"
Mosel, Rhine or Chablis Wine	5	"

(e) *Glowing Punch Extract Without Wine.* (*Substitute for Glowing Wine Punch Extract*)

21. Flavor Essence for Glowing Punch

Carob Tincture	1	lb.
Rhatany Root Tincture	3	"
Wine Distillate	2	gal.

Macerate for a week and press off 8 lbs., and add

Lemon Juice	2	lb.
Ambergris Tincture	½	oz.
	10	lb.

22. Glowing Punch Extract

Cardamom Tincture	1	oz.
Clove "	3	"
Cinnamon "	3	"
Glowing Punch Aroma Essence	9	"
Genuine Rum	¼	gal.
Cherry Juice	2	"
Alcohol	3½	"
Sugar Syrup (60%)	4½	"
	10	lb.

PART VI

CONFECTIONERY, BAKERY AND CULINARY ESSENCES

A. Confectionery Essences

I. ESSENCES FOR FILLING CONFECTIONS WITH THE TASTE OF LIQUORS AND CORDIALS

(a) *Fortified Vegetable Essences*

1. Benedictine.
2. Chartreuse.
3. Mountain Herbs.
4. Alpine Herbs.
5. Walnut.

(b) *Solutions of Volatile Oils*

6. Anisette.
7. Curaçao.
8. Genever.
9. Maraschino.
10. Persico.

(c) *With Taste of Genuine Brandy and Punches*

11. Arrac.
12. Bishop.
13. Cardinal.
14. Corn Whisky.
15. Cognac.
16. Rum, Jamaica Type.
17. " Kingston Type.
18. Rum Punch.
19. Swedish Punch.

(d) *With Liqueur and Ratafia Taste*

20. Cherry Brandy.
21. Cacao.
22. Ginger.
23. Pear Liqueur.
24. Ratafia Cherry.
25. " Raspberry.
26. " Strawberry.
27. Vanilla.

II. ESSENCES FOR MEDICINAL CONFECTIONS AND COUGH DROPS

28. Marshmallow Root.
29. Cough Herbs.
30. Eucalyptus.
31. " Extract.
32. Iceland Moss.
33. Malt Extract.
34. Onion.
35. Pimpinella.
36. Pine Needle.
37. Poppy Flower.
38. Radish.
39. Scorzonera.
40. Plantain.

III. ORIGINAL ESSENCES FROM FRUITS, DRUGS AND VOLATILE OILS

(a) *Fresh Fruits*

41. Banana.
42. Barberry.
43. Bilberry, Black.
44. " Red.
45. Blackberry.
46. Cherry, Black.
47. " Red.
48. " White.
49. Currant, Black.
50. " White.

51. Gooseberry.
52. Melon.
53. Mirabelles.
54. Mulberry.
55. Pineapple.
56. Quince.
57. Raspberry, Red.
58. " Colorless.
59. Green Gage.
60. Strawberry, Red (Garden).
61. " Red (Wild).
62. " Colorless.

(b) Fresh Peels or Volatile Oils of Citrus Fruits

63. General Formula from Peels.
64. " " " Oils.
65. Lemon.
66. Lime.
67. Orange, Bitter.
68. " Sweet.
69. Tangerine.

(c) Dried Fruits

70. Apple.
71. Apricot.
72. Date.
73. Fig.
74. Hips.
75. Grape.
76. Peach.
77. Pear, Jargonelle.
78. Plum.
79. Prunelle.

(d) Kernels of Nuts

80. Cocoanut.
81. Hazel Nut.
82. Pistachio Nut.
83. Walnut Kernel.

(e) Drugs

84. Cacao, Brown.
85. " Colorless.
86. Coffee, Brown.
87. " Colorless.
88. Ginger.
89. Hop.
90. Kola Nut.
91. Malt.
92. Orris Root.
93. Tea.
94. Tea, Colorless.
95. Vanilla Bean.
96. Vanillin Essence.

(f) Volatile Oils

97. Bitter Almond.
98. Eucalyptus.
99. Pine Needle.

IV. "FONDANT" FLAVORS

100. Apricot.
101. Apple.
102. Banana.
103. Barberry.
104. Bergamot.
105. Huckleberry, Black.
106. Bilberry, Red.
107. Blackberry.
108. Cherry, Red.
109. " White.
110. Cherry Brandy.
111. " Spiced.
112. Chocolate, White.
113. " White.
114. Cocoanut.
115. Currant, Black.
116. " Red.
117. " White.
118. Date.
119. English.
120. Fig.
121. Gooseberry.
122. Grape.
123. " Muscatel.
124. Grenadine.
125. Hazel Nut.
126. Hip.
127. Honey.

128. Ice Cream.
129. Kola Nut.
130. Lemon.
131. " Spiced.
132. Lime.
133. Macaroon.
134. Melon.
135. Mirabelle.
136. Morelle.
137. Mouthpearl.
138. Mulberry.
139. Nectar.
140. Nectarine.
141. Nougat.
142. Orange, Bitter.
143. " Sweet.
144. Orgeat.
145. Orris.
146. Peach.
147. Pear.
148. Pineapple.
149. Pistachio Nut.
150. Plum.
151. Prunelle.
152. Quince.
153. Raspberry.
154. Green Gage.
155. Spice Fondant.
156. Strawberry, Garden.
157. " Wild.
158. Tangerine.
159. Walnut.
160. Woodruff.

Wine Fondants

161. Burgundy.
162. Claret.
163. Madeira.
164. Malaga.
165. Muscatel.
166. Port.
167. Rhine.
168. Sherry.
169. Tokay.

V. ORIGINAL FRUIT ETHERS

170. General Formula for Artificial Fruit Ethers.
171. Apricot.
172. Apple.
173. Banana.
174. Barberry.
175. Bilberry, Black.
176. " Red.
177. Butterscotch.
178. Cherry.
179. Cherry Brandy.
180. Cacao.
181. Coffee.
182. Currant.
183. Date.
184. Gooseberry.
185. Grape.
186. Grenadine.
187. Hip.
188. Honey.
189. Hop.
190. Ginger.
191. Lemon.
192. Lime.
193. Malt.
194. Melon.
195. Milk Caramel.
196. Mirabelle.
197. Mulberry.
198. Orange, Bitter.
199. " Sweet.
200. Orris.
201. Peach.
202. Pear.
203. Pineapple.
204. Pistachio Nut.
205. Plum.
206. Quince.
207. Raspberry.
208. Green Gage.
209. Strawberry, Garden.
210. " Wild.
211. Tangerine.
212. Tea.
213. Vanilla.
214. Walnut.
215. Universal Ether.

Special Ethers for Wafer Flavors

216. Arrac.
217. Bitter Almond.
218. Cacao.
219. Chocolate.
220. Coffee.
221. Cognac.
222. Cream.
223. Curaçao.
224. English Wafer.
225. Ice Cream.
226. Maraschino.
227. Nectar.
228. Nougat.
229. Punch.
230. Rum.
231. Woodruff.

VI. CARAMEL FLAVORS

232. Anisette.
233. Apricot.
234. Apple.
235. Arrac.
236. Banana.
237. Benedictine.
238. Barberry.
239. Huckleberry.
240. Bilberry, Red.
241. Bitter Almonds.
242. Blackberry.
243. Butterscotch.
244. Champagne.
245. Chartreuse.
246. Cherry, Red.
247. " White.
248. Cherry Brandy.
249. Cherry Spice.
250. Chocolate.
251. Cacao.
252. Cocoanut.
253. Coffee.
254. Cognac.
255. Curaçao.
256. Currant, Black.
257. " Red.
258. Date.
259. Eucalyptus.
260. Fig.
261. Gooseberry.
262. Grape.
263. " Muscatel.
264. Grenadine.
265. Hazelnut.
266. Hips.
267. Honey.
268. Hop.
269. Kola Nut.
270. Lemon.
271. Lime.
272. Malt.
273. Maraschino.
274. Melon.
275. Milk Caramel.
276. Mirabelle.
277. Mulberry.
278. Nectar.
279. Nectarine.
280. Nougat.
281. Orange, Bitter.
282. " Sweet.
283. Orris.
284. Peach.
285. Pear.
286. Persico.
287. Pineapple.
288. Pine Needle.
289. Pistachio Nut.
290. Plum.
291. Prunelle.
292. Punch.
293. Quince.
294. Quodlibet.
295. Raspberry.
296. Ratafia.
297. Green Gage.
298. Rock Drops.
299. Rum.
300. Swedish Punch.
301. Strawberry, Garden.
302. Strawberry, Wild.
303. Tangerine.
304. Tea.
305. Universal Caramel.
306. Vanilla.
307. Walnut.
308. Woodruff.

VII. WAFER FLAVORS, OIL-SOLUBLE

309. Apricot.
310. Arrac.
311. Banana.
312. Bitter Almonds.
313. Cherry.
314. Chocolate.
315. Cacao.
316. Coffee.
317. Cognac.
318. Cream.
319. Curaçao.
320. Currant.
321. English Wafers.
322. Ice Cream.
323. Lemon.
324. Nectar.
325. Nougat.
326. Orange.
327. Peach.
328. Pear.
329. Pineapple.
330. Pistachio Nut.
331. Punch.
332. Raspberry.
333. Rum.
334. Strawberry.
335. Tangerine.
336. Vanilla.
337. Walnut.
338. Woodruff.

VIII. FLAVORS OF FLOWERS

339. Elder Flower Type.
340. Violet Type.
341. Genuine Flower Essences.
342. " " Ether.
343. Cassie.
344. Heliotrope.
345. Hyacinth.
346. Jasmine.
347. Lilac.
348. Lily of the Valley.
349. Orange Flowers.
350. Rose.
351. Violet.

IX. SPICE EXTRACTS FOR THE BAKERY

(a) *Simple Spice Extracts*

352. Allspice.
353. Anise.
354. Star Anise.
355. Bergamot.
356. Bitter Almond.
357. Calamus.
358. Cardamon.
359. Cinnamon.
360. Cloves.
361. Coriander.
362. Fennel.
363. Ginger.
364. Lemon.
365. Mace.
366. Nutmeg.
367. Orange Flower.
368. Rose.

(b) *Compositions*

369. Arrac, Cognac and Rum.
370. Lemon Spice Extract.
371. Spice Oil for Baking.
372. Tonca Bean Extract.
373. Violet Extract.

(c) *Bakery Spice Extracts*

374. Biscuits.
375. Butter Spice.
376. Gingerbread.
377. Glaze Flavor.
378. Honeycomb.
379. Macaroon.
380. Melangebits.
381. Pastry.
382. Plum Pudding.
383. Printen.
384. Speculatius.
385. Tea Biscuits.
386. Wedding Cake.

X. CONFECTIONERY LACQUERS

387. Benzoin Resin, Purified.
388. Purified Bleached Shellac.
389. Benzoin Lacquer.
390. Lacquer for Chocolates.
391. Brilliant Lacquer for Confections.
392. Glaze Lacquer for Foam Confections.
393. Lacquer for Gingerbread.
394. Marchpane Lacquer from Sandarac.
395. Marchpane Lacquer from Shellac.

B. Culinary Essences

I. SPICE EXTRACTS

(a) Solutions of Volatile Oils

396. Allspice.
397. Basil Herb.
398. Bitter Almond.
399. Caraway.
400. Celery.
401. Cinnamon, Ceylon.
402. Cloves.
403. Coriander.
404. Dill.
405. Tarragon.
406. Fennel.
407. Laurel Leaves.
408. Marjoram.
409. Mugwort.
410. Parsley.
411. Savory.
412. Sage.
413. Thyme.

(b) Fortified Vegetable Extracts

414. Anise.
415. Calamus.
416. Cardamom.
417. Cinnamon Flowers.
418. Ginger.
419. Juniper Berry.
420. Mace and Nutmeg.
421. Pepper, Black and White.

(c) Simple Vegetable Extracts

422. Asparagus.
423. Capsicum or Chillies.
424. Saffron.
425. Vanilla.

(d) Extracts from Fresh Vegetables

426. Capers.
427. Carrots.
428. Chervil.

(e) Fungi Extracts

429. Champignons.
430. Morels.
431. Mushrooms.
432. Truffles.

(f) Onion Extracts

433. Chives and Garlic.
434. Onions.
435. Leeks.
436. Shallots.

II. CULINARY SPICE EXTRACT COMPOUNDS

(a) Meat-Spice Extracts

437. For Beef, Veal and Fowl.
438. For Mutton, Pork and Smoked Meats.
439. For Game, and Wild Fowl.

440. Boiled and Broiled Fish.
441. Pickled Meats, Crabs, etc.
442. Meat Fillings, Forced Meats, etc.
443. Gulashes, Ragouts, Mock Turtle, etc.
444. Patties.
445. Brines, etc.
446. Soups.
447. Sausage Spice Extract for Sausage, etc.
448. " " " " Hausmacher Sausage.
449. " " " " Smoked Sausage, Salami, Mortadella, etc.
450. Spice Extract for Mulled Beer, Punch, Mulled Wine, etc.

(b) Pickled Spice Extracts

451. Spiced Pickle Extract.
452. Curry.
453. Tarragon.
454. Fines Herbes.
455. Mixed Pickles.
456. Mustard Pickles.
457. Piccalilli.
458. Salt Pickles.

III. VINEGAR ESSENCE SPICES

459. Aux Fines Herbes.
460. Celery Vinegar.
461. Tarragon Vinegar.
462. Fruit Vinegar.
463. Malt Vinegar.
464. Mustard Vinegar.
465. Wine Vinegar.

IV. SPICE SALTS

(a) Simple Spice Salts

466. Celery Salt.
467. Pepper Salt.

(b) Compound Spice Salts

468. Bouillon Spice Salt.
469. Roast Spice Salt.
470. Game Spice Salt.
471. Fish Spice Salt.

(c) Sausage Spice Salts

472. Sausage Spice Salt.
473. For Country Sausage.
474. For Smoked Sausage.
475. For Liver Sausage.
476. For Tongue Sausage.
477. For Onion Sausage.

(d) Pickle Spice Salts

478. Spiced-Pickle Spice Salt.
479. Salt-Pickle Spice Salt.

PART VI

CONFECTIONERY, BAKERY AND CULINARY ESSENCES

A. Confectionery Essences

I. ESSENCES FOR FILLING CONFECTIONS WITH THE TASTE OF LIQUORS AND CORDIALS

(a) *Fortified Vegetable Essences*

General Method:

Macerate 5 lb. of the drugs with 10 lb. proof spirit, allow to stand for a week, then express off 6 lb. extract. Then add the volatile oils to the residue, add 10 lb. water, place in the still, and distil off the whole alcohol content, then add water to bring the distillate to about 17° underproof, filter with the aid of infusorial earth to remove the terpenes, and rectify the filtrate to a yield of 4 lb., which then mix with the expressed extract to the final yield of 10 lb. After allowing to stand a few days, filter the essence if it is not quite clear.

1. Benedictine Essence

Tonka Beans	1¼ oz.
Calamus Root	4 "
Thyme Herb	4 "
Mace	4 "
Cinnamon Bark	4 "
Cloves	4 "
Arnica Flowers	6¾ "
Angelica Seed	10 "
Musk Mallow Seed	10 "
Angelica Root	1 lb.
Balm Leaves	1 "
	5 lb.

Addition:

Oil of Coriander	7 dr.
" " Cardamom	7 "
" " Peppermint	1½ oz.
" " Lemon	4 "

2. Chartreuse Essence

Balm Mint	2¼ oz.
Cinnamon Flowers	4½ "
Galanga Root	5 "
Ginger Root	5 "
Iva Herb	10 "
Calamus Root	13 "
Zedoary Root	1 lb. 3 "
Bitter Orange Peel	1 lb. 5 "
	5 lb.

Addition:

Oil of Lemon	¾ oz.
" " Angelica	1¼ "
" " Coriander	1½ "
" " Thyme	1½ "
Acetic Ether	4 "

3. Mountain Herbs Essence for Herb Caramel

Balm Mint		2½ oz.
Cinnamon Flowers		4 "
Galanga Root		4½ "
Angelica Root		7 "
Balm Leaves		10 "
Bitter Orange Peel	1 lb.	8 "
Unripe Bitter Orange Fruit	1 "	12 "
	5 lb.	

Addition:

Ethyl Formate	¼ lb.
Ethyl Acetate	½ "

4. Swiss Alpine Herbs Essence

Balm Mint	2½ oz.
Cinnamon Flowers	4 "
Galanga Root	4½ "
Angelica Root	7 "
Balm Leaves	10 "
Bitter Orange Peels	1½ oz.
Unripe Bitter Orange Fruits	1¾ "
	5 lb.

Addition:

Ethyl Formate	¼ lb.
Ethyl Acetate	½ "

5. Walnut Essence from Fresh Walnuts

Crush 10 lb. of fresh, quite unripe walnuts, harvested in July, macerate with 7½ lb. strong alcohol, and express off after three days 10 lb. extract.

Addition:

Oil of Mace	¾ dr.
Amyl Butyrate	2¼ "
Oil of Lemon	4 "
Ethyl Œnanthate	4 "
Benzaldehyde	4 "

(b) *Solution of Volatile Oils to Imitate the Taste of Liqueurs*

6. Anisette Essence

Oil of Lemon, Terpeneless	¼ dr.
" " Cardamom	¼ "
" " Cinnamon	¾ "
" " Cloves	1 "
" " Coriander	1¼ "
" " Calamus	1½ "
" " Star Anise	11 "
Wine Distillate	1½ "
Distilled Water	1½ "
Alcohol	12 "
	1 lb.

7. Curaçao Essence

Oil of Sweet Orange		¼ dr.
" " Lemon		¾ "
" " Ginger		¾ "
" " Cinnamon		1¼ "
" " Bitter Orange, Terpeneless		2 "
Wine Distillate	2 oz.	11 "
Rose Water	2 "	
Alcohol	11 "	
	1 lb.	

8. Genever Essence (Juniper)

Oil of Juniper, Terpeneless		3 dr.
Lemon Distillate	1 oz.	13 "
Grain Brandy	4 "	
Alcohol	10 "	
	1 lb.	

9. Maraschino Essence

Oil of Cinnamon	¼ dr.
Ethyl Acetate	7¾ "
Ethyl Nitrite	12 "
Orange Flower Water	12 "
Raspberry Distillate	1½ oz.
Wine Distillate	1½ "
Rose Water	2 "
Common Laurel Water	2½ "
Alcohol	3 "
Cherry Fruit Essence	3½ "
	1 lb.

10. PERSICO ESSENCE

Oil of Lemon	1¼ dr.
" " Cinnamon	2½ "
" " Benzaldehyde	3¼ "
" " Common Laurel	3¾ "
Fruit Flavor Oil of Peach	5¼ dr.
Rose Water	2 oz.
Wine Distillate	2 "
Bitter Almond Water	3 "
Alcohol	8 "
	1 lb.

(c) *Taste of Genuine Brandies and Punches*

The employment of rum and arrac essence alone is not suitable, but the taste must be refined by adding genuine liquors.

11. ARRAC ESSENCE

Vanillin	2½ dr.
Arrac Essence	13½ "
Genuine Arrac	15 oz.
	1 lb.

12. BISHOP ESSENCE

Vanilla Tincture	5 dr.
Mace Tincture	11 "
Cardamom Tincture	12 "
Cloves Tincture	3¼ oz.
Cinnamon Tincture	3 "
Sweet Orange Distillate	4 "
Rum, Genuine	4 "
	1 lb.

13. CARDINAL ESSENCE

Mace Tincture	¾ oz.
Cloves Tincture	1¼ "
Cinnamon Tincture	1½ "
Lemon Peel Essence	4 "
Rum, Genuine	4 "
Sweet Orange Distillate	4½ "
	1 lb.

14. CORN WHISKY ESSENCE

Vanillin		3 dr.
Caraway Essence		6 "
Malt Distillate	1 oz.	7 "
Wine Distillate	4 "	
Alcohol	4 "	
Grain Whisky	6 "	
	1 lb.	

15. COGNAC ESSENCE

Vanillin		3 dr.
Wine Brandy	1 oz.	13 "
Genuine Cognac	7 "	
Alcohol	7 "	
	1 lb.	

16. RUM FILLING ESSENCE
(Jamaica Type)

Vanillin	3 dr.
Catechu Tincture	6 "
Rum Essence	7 "
Genuine Rum	5 oz.
Alcohol	10 "
	1 lb.

17. RUM FILLING ESSENCE
(Kingston Type)

Vanillin		3 dr.
Rum Essence	1 oz.	13 "
Genuine Rum	4 "	
Alcohol	10 "	
	1 lb.	

18. RUM PUNCH ESSENCE

Pineapple Essence	2½ oz.
Sweet Orange Essence	3½ "
Lemon Peel Essence	4 "
Genuine Rum	6 "
	1 lb.

19. SWEDISH PUNCH ESSENCE

Genuine Rum	¾ oz.
Arrac Essence No. 11	1¼ "
Lemon Peel Essence	4 "
Genuine Arrac	10 "
	1 lb.

(d) *With Liqueur and Ratafia Taste*

20. Cherry-Brandy Essence

Genuine Cherry Brandy	1½ oz.
Cherry Fruit Juice	3½ "
Cherry Fruit Essence	5 "
Alcohol	6 "
	1 lb.

21. Cacao Liqueur Essence

Genuine Arrac	1½ oz.
Alcohol	6½ "
Cacao Essence, Brown	8 "
	1 lb.

22. Ginger Liqueur Essence

Wine Distillate	1½ oz.
Ginger Essence	6½ "
Alcohol	8 "
	1 lb.

23. Pear Liqueur Essence

Wine Distillate	1½ oz.
Bergamot Essence	7 "
Alcohol	7½ "
	1 lb.

24. Ratafia of Cherry Essence

Grain Whisky	1½ oz.
Genuine Cherry Brandy	1½ "
Cherry Fruit Essence	6 oz.
Alcohol	7 "
	1 lb.

25. Ratafia of Raspberry Essence

Wine Distillate	1½ oz.
Raspberry Juice	3½ "
" Essence	5 "
Alcohol	6 "
	1 lb.

26. Ratafia Essence of Strawberry

Wine Distillate	1½ oz.
Strawberry Juice	3½ "
" Essence	5 "
Alcohol	6 "
	1 lb.

27. Vanilla Liqueur Essence

Vanillin		5 dr.
Wine Distillate	1 oz.	11 "
Vanilla Essence	4 "	
Alcohol	10 "	
	1 lb.	

II. ESSENCES FOR MEDICINAL CONFECTIONS AND COUGH DROPS

These consist chiefly of a tincture of the drugs mixed with universal caramel ether (No. 215), or with medicinal extracts added. The base is a tincture of 1 lb. drug with 4 parts proof spirit, 3 lb. of extract being expressed off after three days standing.

General Formula

Malt Extract, Inspissated	1 oz.
Boiling Water	3 "

Dissolve, and after cooling, add

Universal Caramel Ether	1 "
Drug Tincture (as above)	12 "
	1 lb.

28. Marshmallow Root Essence

As per general formula.

29. Cough Herbs Essence

For cough caramels.

Angelica Seed	¾ oz.
Coriander	¾ "
Star Anise	1½ "
Angelica Root	1½ "
Balm Leaves	3½ "
Licorice Root	4 "
Pimpinella Root	4 "

Macerate with 4 lb. proof spirit and after three days standing express off 3 lb., which use as per general formula above.

30. Eucalyptus Essence

Oil of Peppermint	½ dr.
Alcohol	15½ "
Universal Caramel Ether	1 oz.
Tincture of Eucalyptus Leaves	14 "
	1 lb.

31. Eucalyptus Extract Essence

Inspissated Aqueous Eucalyptus Extract	2 oz.
Boiling Water	4 "

After cooling, add

Eucalyptol	½ "
Universal Caramel Ether.	1 "
Alcohol	8½ "
	1 lb.

32. Iceland Moss Essence

As per general formula.

33. Malt Extract Essence

Malt Extract, Inspissated.	2 oz.
Boiling Water	6 "
Universal Caramel Ether	1 "
Malt Distillate	5 "
Alcohol	2 "
	1 lb.

34. Onion Extract Essence

Macerate 2 lb. fresh peeled and crushed onions with 5 lb. alcohol for three days, and then express off about 4 lb.

Composition:

Oil of Mustard	¼ dr.
Alcohol	¾ oz.
Universal Caramel Ether	1 "
Onion Extract (as above)	14 "
	1 lb.

35. Pimpinella Essence

As per general formula.

36. Pine-Needle Essence

Oil of Pine Needles, Terpeneless	½ dr.
Universal Caramel Ether	15½ "
Alcohol	11 oz.
Water	4 "
	1 lb.

37. Poppy Flower Essence

Oil of Rose	1 drop
" " Fennel	½ dr.
Alcohol	15½ "
Universal Caramel Ether.	1 oz.
Tincture of Poppy Flowers	14 "
	1 lb.

38. Radish Extract Essence

Make an essence from fresh black radish in the same manner as in making onion extract, and use also the same composition for the essence.

39. Scorzonera Essence

As per general formula.

40. Plantain Essence

As per general formula.

III. ORIGINAL ESSENCES FROM FRUITS, DRUGS AND VOLATILE OILS AS FOUNDATION FOR ANY CONFECTIONERY ESSENCE

The following essences are intended to serve as bases for other compositions, such as caramel and "fondant" flavors and natural fruit ethers. To most of those essences an addition of volatile oils or esters as "fixage" is allowed.

(a) *Fresh Fruits*

41. Banana Essence

10 lb. fresh but not overripe bananas are peeled, and only the pulp is used.

Macerate with 20 lb. proof spirit, and after standing three days express off about 10 lb. extract.

To the residue add

Water	2 gal.
Solution of Chamomile Oil (1 : 10)	2½ dr.
Amyl Butyrate	6 "
Oil of Coriander	12 "

Distil off 5 lb. and mix with extract obtained as above.

Result 15 lb.

42. Barberry Essence

Express 10 lb. fully ripe barberries collecting 7 lb. of juice and 3 lb. residue. Macerate the latter with 3 lb. alcohol for three days and then express off 3 lb. extract. The residue is mixed with the reserved juice, 12 dr. ethyl butyrate are added, and the mixture is distilled, the distillate being rectified to a yield of 2 lb. which mix with the extract to a final yield of 5 lb.

43. Bilberry Essence, Black

2 quarters of black bilberries are crushed and after adding 2 lb. sugar, fermented for some days to develop the flavor. Express off the juice and collect about 20 lb. residue which macerate with 15 lb. alcohol for three days, then express off 15 lb. extract, and distil the residue with 4 gallons of water, then add

Oil of Coriander	1¼ dr.
" " Fennel	2½ "
Amyl Butyrate	4 "
Ethyl Acetate	12 "

and rectify the distillate to a yield of 5 lb., which then mix with the above extract to a final yield of 20 lb.

44. Red Bilberry Essence (Also Cranberries)

Make in the same manner as above from black bilberries, but add for the distillation

Oil of Rose	⅛ dr.
Methyl Salicylate	1¼ "
Ethyl Benzoate	1 oz.

Result 20 lb.

45. Blackberry Essence

From very ripe blackberries in the same manner as bilberry essence, but with the addition before the distillation of 6 dr. methyl salicylate. Result 20 lb.

46. Black Cherry Essence

The black cherries are more aromatic than the sour cherries (Agriots). The cherries are crushed, but with only the half of the kernels. Then ferment 1 cwt. of the mash with 5 lb. sugar for a few days, express off the juice, and collect about 1 quarter residue, which macerate

with 15 lb. alcohol for three days, and express off 20 lb. of extract. The residue distil off with the juice after adding

Ethyl Benzoate	2½ oz.
Amyl Formate	3 "

Rectify the distillate to a yield of 5 lb., which then mix with the extract to a final result of 25 lb.

47. Cherry Essence, Red (Agriot)

Same formula as before, fermented with same additions.

48. Cherry Essence, Colorless

1 cwt. cherries, crushed with all their kernels and fermented with 5 lb. sugar, are distilled off with the addition of 15 lb. alcohol and

Genuine Cognac Oil	4 dr.
Ethyl Benzoate	2½ oz.
Amyl Formate	4 "

The distillate rectify to a final result of 25 lb.

49. Currant Essence, Red or Black

The black currants are best suited, and if red currants are used, substitute at least 30% of them with black currants for the pronounced flavor desired.

1 cwt. of the berries are fermented with 5 lb. sugar for a few days to develop the flavor. Add now 6 gallons alcohol, and distil off without expressing 6 gallons distillate, collecting the remaining alcohol in an after-distillate.

Take another hundred weight of fermented currants, and express these. Result about 1 quarter residue, which macerate for a day or two with the distillate of 6 gallons obtained, and express off about 6 gallons of extract.

The remainder distil off with the juice obtained after adding the after-distillate and

Ethyl Pelargonate	6 dr.
Anisaldehyde	6 "
Ethyl Benzoate	12 "
Ethyl Acetate	12 "

Rectify the distillate to yield 10 lb., which mix with the extract, and add water to a yield of 2 quarters essence.

50. Currant Essence (Colorless)

Manufacture as above with fermented black currants only, but distil off completely without fractionating. This distillate use as a medium for a second batch of fermented fruits, with the addition of

Oil of Cognac	4 dr.
Ethyl Pelargonate	6 "
Ethyl Benzoate	12 "
Ethyl Acetate	12 "

Final result, 2 quarters.

51. Gooseberry Essence

Made from ripe red or yellow (not green) gooseberries in the same manner as bilberry essence, but add before distillation the following:

Amyl Acetate	12 dr.
Ethyl Acetate	1½ oz.

Result 20 lb.

52. Melon Essence

1 cwt. fresh sugar melons (watermelons are not suited) are peeled and crushed. Remove the seeds with a sieve. The pulp macerate with 10 lb. alcohol and after standing three days collect 10 lb. The rest distil off with 2 gallons of water after adding 1½ oz. ethyl butyrate, and rectify to 5 lb., which mix with the extract to a final result of 15 lb.

The juice is worthless.

53. Mirabelle Essence

1 cwt. yellow mirabelles are freed from the stones, and after crushing are fermented with 5 lb. sugar for a few days. Press off the juice and macerate the remainder with 15 lb. alcohol for three days, then express off 15 lb. The rest distil off with the obtained juice after adding 6 dr. amyl valerate, and rectify the distillate to yield 5 lb. which then mix with the extract. Result 20 lb.

54. Mulberry Essence

Make from black or red mulberries in the same way as bilberry essence, but add before distillation

Methyl Salicylate........ $1\frac{1}{4}$ dr.

Result 20 lb.

55. Pineapple Essence

Peel 10 lb. fresh pineapples. Macerate the 2 lb. or so of peels with 2 lb. alcohol. The pulp is then expressed, and macerated again in another vessel with $1\frac{1}{2}$ lb. alcohol. Express this first, and obtain about 2 lb. pulp extract. Express the peels and obtain 2 lb. peel extract. The extracted peels macerate once more with the pulp extract obtained, and press off a day later a further 2 lb. extract, which mix with the first peel extract.

The remainder of the two macerates distil off with the juice of the pulp and 6 dr. amyl butyrate, and then rectify to 1 lb. This add to the mixed extract essence to obtain a final yield of 5 lb.

56. Quince Essence

Ripe quinces must lie for some weeks on straw to develop their flavor. 1 cwt. such quinces are crushed and expressed. The residue is macerated with 20 lb. alcohol for three days and then expressed to yield 20 lb. extract. The remaining residue is distilled off with the juice obtained and

Ethyl Valerate...........	6 dr.
Amyl Acetate............	12 "

and the distillate rectified to yield 5 lb., which mix with the extract to a final yield of 25 lb.

57. Raspberry Essence, Red

Made in the same way as currant essence. The berries are fermented for a few days with sugar, and the mash distilled with alcohol. The first fraction serves for macerating the residue of the second batch. The final distillation requires no aromatic additions before distilling, but when distillate and extract are mixed to the result of 2 quarters, 6 dr. vanillin are added as fixage.

58. Raspberry Essence
(Colorless)

Represents the colorless essence of currants, but no aromatic additions are made.

To the final result of 2 quarters add 6 dr. vanillin.

59. Green Gage Essence

Made from small blue green gages in the same way as essence of mirabelles with a yield of 20 lb. from 1 cwt fruits. The same additions are also to be made.

60. Strawberry Essence, Red
(From garden strawberries)

Use small, red, freshly harvested strawberries, and express off without fermentation. 1 cwt. of fruit yields about 3 quarters juice and 1 quarter residue, which latter is macerated

with 30 lb. alcohol for three days. Express off 35 lb. extract, and distil the remainder mixed with the juice obtained. Then add

Oil of Cognac	4 dr.
Ethyl Acetate	4 oz.

and rectify the distillate to 15 lb., which mix with the extract to a final yield of 50 lb.

61. Strawberry Essence, Red
(From Wild Strawberries)

Wild strawberries must not be fermented (during transport or otherwise), because the flavor is impaired by fermentation. Use the same method as above, but add as flavoring addition the following:

Methyl Salicylate	4 dr.
Oil of Allspice	8 "

Final result 50 lb.

62. Strawberry Essence
(Colorless)

The flavor of strawberries is very sensitive to heat, and hence essences must be distilled in the vacuum apparatus.

Macerate 30 lb. of fresh strawberries for a day with 10 lb. alcohol, and then distil with the addition of

Methyl Salicylate	2½ dr.
Oil of Cognac	2½ "
" " Allspice	5 "
Amyl Butyrate	2½ oz.

and without rectification to a final yield of 30 lb.

(b) *Fresh Peels or Volatile Oils of Citrus Fruits*

63. General Method for Essences of the Peels from Citrus Fruits for Confectionery

Macerate 10 lb. of fresh peels with 20 lb. of alcohol for three days and then express off 20 lb. extract. The remainder is distilled with 5 gallons of water to 10 lb. distillate, from which separate the terpenes, and then mix the alcoholic liquid with the extract. Result 10 lb. This essence is not suited for liqueurs or lemonades, but for the finest confections, as ices, creams, etc., where strictly clear products are not required.

In this manner the peels of all the citrus fruits are worked up, as lemons, limes, sweet and bitter oranges, and tangerines.

64. General Method for Confectionery Essences from Volatile Oils of Citrus Fruits

The solution of volatile oils in alcohol alone will not suffice in every case, because the terpenes impair the concentration and the flavor of the products. The terpenes are removed in the manner already described. 10 lb. of the volatile oil are distilled, using the return tube and the Florence flask, with 10 gallons of alcohol of 17° underproof until terpenes no longer separate in the bottle, then remove the separated terpenes, which will reach the average

of 90% of the oil employed, and distil off the still contents to a final yield of 60 lb., which filter if necessary. To round out the flavor use, besides the volatile oil, some volatile additions as follows. The formulas are calculated on the employment of each 10 lb. of oils to a yield of 60 lb. of essence:

65. Lemon Essence

Oil of Peppermint, Mitcham	12 dr.
Oil of Lemon	10 lb.

66. Lime Essence

Either

Oil of Peppermint	12 dr.
Oil of Limes	10 lb.

or

Oil of Limes	4 lb.
" " Lemon	6 "

67. Orange Essence, Bitter

Oil of Petitgrain	½ lb.
" " Bitter Orange	9½ "

68. Orange Essence, Sweet

Oil of Cinnamon, Ceylon	2 oz.
" " Sweet Orange	10 lb.

69. Tangerine Essence

Oil of Thyme	1½ oz.
" " Tangerine	4 lb.
" " Sweet Orange	6 "

(c) *Dried Fruits*

For the essences of the following the fresh fruits are less advantageous, the dried fruits being best adapted because of their extractive content, but they must be fresh, and not more than a year old, and in every case from last harvest. The further advantage of using dried fruits is the possibility of manufacturing preparations independently of any season.

70. Apple Essence

Take chopped apples, or if in good condition dried apple parings, and macerate 10 lb. with 20 lb. proof spirit for three days, then add 5 gallons of water, and distil off 20 lb., which use as a menstruum for the maceration with a fresh 10 lb. fruits.

After again standing three days distil off, after adding 5 gallons of water and 2½ dr. Amyl Valerate, to a final yield of 20 lb. essence.

71. Apricot Essence

Use the same method as for apple essence, but as addition for the final distillation use

Ethyl Valerate........... 2½ oz.

72. Date Essence

73. Fig Essence

74. Hip Essence

These are all made in the same way as apple essence, but as addition for the last distillation use

Ethyl Acetate............ 2½ oz.

75. Grape Essences

Several kinds of raisins serve as material, *i.e.*, for *muscatel grape essence* the stalk-free Malaga grapes; for the *champagne taste* the stoned Sultana raisins; and for the *red-wine taste* the small blue corinths.

The manipulation is in every case the following:

10 lb. of the raisins are treated with 10 lb. hot wine and allowed to swell for a day. For muscatel essence and for champagne essence use samos wine or any sweet clear wine; for red-wine type, use claret. Afterwards pour on 8 lb. alcohol and 2 lb. Wine Distillate. After standing for three days express off about 12 lb. extract. The residue distil with

Oil of Mace	5 dr.
" " Cognac	5 "
Ethyl Œnanthate	3½ oz.

The result of this distillation without necessary rectification is 8 lb., which mix with the extract to a final yield of 20 lb.

These grape-essences are the basis of the so-called wine flavors for "fondants."

76. Peach Essence

Use the same method as for apple essence, using dried peaches, but adding

Ethyl Valerate	1½ oz.
Amyl Valerate	2 "

77. Pear Essence (Jargonelle)

Use the same method as for apple essence, but with the addition to the last distillation of

Oil of Bergamot	2½ dr.
" " Coriander	2½ "
Amyl Acetate	12 "

78. Plum Essence

79. Prunelle Essence

Same method as for apple essence. Distil with the addition of

Amyl Valerate	2½ oz.

(*d*) *Nut Kernels*

The kernels must be as fresh as possible, and must not have the slightest rancid taste. The nut kernels are known to be very rich in fatty oils, which are insoluble in alcohol, and render the essences turbid. This must be avoided. If any fatty oil is taken up by the essence, it must be removed by freezing out. The method is a general one for all kinds of nuts.

80. Cocoanut Essence

81. Hazel Nut Essence

82. Pistachio Nut Essence

83. Walnut Kernel Essence

10 lb. of the rasped nuts are macerated with 30 lb. proof spirit and stirred often during 10 days. Collect, without any pressure, 20 lb. of extract, and distil the residue with 5 gallons of water and

Ethyl Œnanthate	12 dr.
Amyl Formate	1½ oz.

to obtain 10 lb., and mix the distillate with the extract to a final yield of 30 lb.

(*e*) *Drugs*

The general method is to macerate or percolate the drugs with alcohol of various suitable strengths, and to distil the residue.

If colorless qualities are wanted, distil off the complete essence in one operation, but in most cases the colorless essences have less flavor and are not so fine as the others.

84. Cacao Essence, Brown

To give the essence an increased utilizability a tincture of ground cacao shells is employed as a basis. 10 lb. ground cacao shells are macerated with 30 lb. proof spirit. After three days collect 20 lb. extract and distil the residue with 5 gallons of water to yield 10 lb., which mix with the extract. This serves as a menstruum for the following extraction of freshly roasted, ground cacao beans. 10 lb. of these cacao beans (cocoa, as deoleated powder is not suitable) macerate for ten days with the above extract of cacao shells, then collect 20 lb. extract, and distil the residue with 5 gallons of water to a yield of 10 lb., which mix with the extract, and add 6 dr. vanillin. Final yield 30 lb.

85. Cacao Essence, Colorless

Macerate 10 lb. roasted cacao beans with 20 lb. proof spirit for a week, and then after adding 3 gallons water, distil off very slowly essence 20 lb., to which add vanillin 10 dr.

86. Coffee Essence, Brown

Freshly Roasted Coffee...	5 lb.
Genuine Arrac...........	3 "
Water..................	9 "

Macerate for one day only, percolate, then pour on 1 gallon of alcohol 37° underproof, and percolate to a yield of 15 lb. Use this percolate as a menstruum for a further 5 lb. of coffee, which macerate for a day and percolate, using the after-percolate of the first batch, to yield 15 lb. of finished essence.

87. Coffee Essence, Colorless

Macerate 10 lb. of freshly roasted coffee for one day with 4 lb. alcohol and 10 lb. water, and then distil off very slowly 10 lb. essence, to which add 6 dr. vanillin.

88. Ginger Essence

Grains of Paradise.......	12 dr.
Galanga Root...........	$1\frac{1}{2}$ oz.
Jamaica Ginger..........	1 lb.

Macerate for three days with 4 lb. proof spirit and express off 3 lb. extract. The residue distil with sufficient water to a yield of 1 lb., which mix with the extract to a final yield of 4 lb.

89. Hop Essence

Macerate 1 lb. freshly dried hop flowers with 10 lb. proof spirit, and after a week press off 9 lb. extract.

90. Cola Nut Essence

Macerate 1 lb. roasted cola nuts with 4 lb. proof spirit. After a week express off 3 lb. extract.

91. Malt Essence

Light Dried Malt, Crushed	10 lb.
Cardamom..............	10 oz.
Water..................	6 gal.

Heat to about 140° F. and allow to stand at this temperature for two hours. Then add alcohol 10 lb., and distil off slowly 23 lb., wherein dissolve 2 lb. inspissated malt extract and lastly $\frac{1}{8}$ dr. genuine honey flavor oil. Result 25 lb.

92. Orris Root Essence

Florentine Orris Root	10 lb.
Alcohol	10 "

Allow to stand one day. Then macerate the root further with 40 lb. proof spirit and after a week express off 40 lb. extract. Distil the residue with 5 gallons of water after adding

Amyl Acetate	12 dr.
Ethyl Œnanthate	2½ oz.
Ethyl Acetate	4 "

to a yield of 10 lb., which mix with the extract to a final yield of 50 lb.

93. Tea Essence

Finest Ceylon Tea	2 lb.
Rose Flower Leaves	6 oz.
Genuine Arrac	2 pints

Allow to stand for one day, then add 2 gallons boiling water. After standing one hour express off 8 lb. extract. Add further

Lemon Peel Essence	12 dr.
Pineapple Essence	1 lb.
Orange Flower Water	4 dr.

Result 10 lb.

94. Tea Essence, Colorless

Rose Flower Leaves	10 oz.
Ceylon Tea	3 lb.
Genuine Arrac	2 pints
Alcohol	5 "

Allow to macerate for one day, then after adding 4 gallons of water distil off very slowly 9 lb. distillate, to which add

Lemon Peel Essence	½ lb.
Orange Flower Water	½ "
Vanillin	6 dr.

Result 10 lb.

95. Vanilla Bean Essence

Macerate 1 part vanilla beans with 4 parts proof spirit for 10 days.

For cheaper qualities some genuine vanilla beans are replaced by Tahiti Vanilla (Vanillons). Otherwise, vanilla is partly replaced by vanillin.

96. Vanillin Essence
(Colorless)

Heliotropin	1¼ dr.
Vanillin Crystals	14¾ "
Glycerin	1½ oz.
Distilled Water	5½ "
Alcohol	8 "
	1 lb.

(*f*) *Volatile Oils*

97. Bitter Almond Essence

Benzaldehyde	1½ oz.
Alcohol	12½ "
Distilled Water	2 "
	1 lb.

98. Eucalyptus Essence

Menthol	2½ dr.
Eucalyptol	5½ "
Arrac	2½ oz.
Alcohol	13 "
	1 lb.

99. Pine Needle Essence

Oil of Pine Needles, Terpeneless	8 dr.
Genuine Arrac	2½ oz.
Alcohol	13 "
	1 lb.

IV. "FONDANT FLAVORS"

These are employed for preparations in the making of which little heat is employed, as also for ices, creams, jellies, marmalades, fruit pastes, etc., which can only be prepared in the cold, or lastly

where a fine fruity flavor is desired. Even for puddings, biscuits, icings for cakes, and bakery products, these fruit essences, or the compounded essences, are popularly employed. In making them the basic fruit essences or other basic essences described in Part III are used, and usually with the addition of a suitable fixing agent or taste corrective.

100. Apricot Fondant

Vanillin	2½ dr.
Peach Flavor Oil	5½ "
Cherry Laurel Water	7½ oz.
Basic Apricot Essence	9½ lb.
	10 lb.

101. Apple Fondant

Clove Tincture	3 oz.
Orange Essence	5 "
Basic Apple Essence	9½ lb.
	10 lb.

102. Banana Fondant

Orange Essence	4 oz.
Orange Flower Water	6 "
Lemon Essence	6 "
Basic Banana Essence	9 lb.
	10 lb.

103. Barberry Fondant

Raspberry Essence	½ lb.
Black Currant Essence	½ "
Lemon Essence	1½ "
Barberry Essence	7½ "
	10 lb.

104. Bergamot Fondant

Oil of Bergamot	1 dr.
Vanillin	7 "
Lemon Essence	7½ oz.
Basic Pear Essence	9½ lb.
	10 lb.

105. Black Huckleberry Fondant

Heliotropin	3½ dr.
Cumarin	4½ "
Alcohol	7½ oz.
Black Currant Essence	1 lb.
Basic Huckleberry Essence	8½ "
	10 lb.

106. Red Bilberry Fondant

Vanillin	3½ dr.
Cumarin	4½ "
Alcohol	7½ oz.
Basic Red Bilberry Essence	9½ lb.
	10 lb.

107. Blackberry Fondant

Birch Tar Oil	⅛ dr.
Solution Orris Oil (10%)	2⅜ "
Heliotropin	5½ "
Lemon Essence	7½ oz.
Black Currant Essence	1½ lb.
Basic Blackberry Essence	8 "
	10 lb.

108. Red Cherry Fondant

Benzaldehyde	2½ dr.
Vanillin	6 "
Basic Red Cherry Essence	10 lb.
	10 lb.

109. White Cherry Fondant

Lemon Oil, Terpeneless	1¼ dr.
Cognac Oil	2¾ "
Vanillin	12 "
Benzaldehyde	2 oz.
Colorless Basic Cherry Essence	9 lb. 13 dr.
	10 lb.

110. Cherry Brandy Fondant

Neroli Oil	⅛ dr.
Clove Oil	3⅞ "
Ceylon Cinnamon Oil	6 "
Benzaldehyde	14 "
Cherry Laurel Water	14½ oz.
Genuine Cherry Water	4 lb.
Basic Cherry Essence	5 "
	10 lb.

111. Spiced Cherry Fondant

Peppermint Oil	1/32	dr.
Calamus Oil	2½	"
Peach Flavor Oil	4½	"
Benzaldehyde	12	"
Vanillin	5	"
Orange Essence	4½	oz.
Lemon Essence	10	"
Basic Red Cherry Essence	9	lb.
	10	lb.

112. Brown Chocolate Fondant

Cardamom Tincture	1½	oz.
Vanilla Tincture	4	"
Clove Tincture	6½	"
Ceylon Cinnamon Tincture	12	"
Brown Basic Cacao Essence	8½	lb.
	10	lb.

113. White Chocolate Fondant

Cardamom Oil	4 dr.
Clove Oil	5 "
Ceylon Cinnamon Oil	7 "
Vanillin	5 oz.
White Cacao Essence	9 lb. 10 oz.
	10 lb.

114. Cocoanut Fondant

Ceylon Cinnamon Oil	5	dr.
Clove Oil	5	"
Mace Oil	14	"
Sweet Orange Oil	3	oz.
Butyric Acid (100%)	3½	"
Cocoanut Essence	9½	lb.
	10	lb.

115. Black Currant Fondant

Nerolin	2½	dr.
Vanillin	5	"
Basic Black Currant Essence	10	lb.
	10	lb.

116. Red Currant Fondant

Peppermint Oil	⅛	dr.
Vanillin	5½	"
Red Currant Essence	10	lb.
	10	lb.

117. White Currant Fondant

Cognac Oil	2½	dr.
Vanillin	6	"
White Currant Essence	10	lb.
	10	lb.

118. Date Fondant

Calamus Oil, Terpeneless	1	dr.
Peppermint Oil	1½	"
Cherry Laurel Water	¼	lb.
Pineapple Essence	½	"
Date Essence	9¼	"
	10	lb.

119. English Fondant

Heliotropin	7	dr.
Benzyl Acetate	1	oz.
Vanilla Essence	7	"
Raspberry Essence	1	lb.
Gooseberry Essence	1½	"
Apricot Essence	2	"
Pineapple Essence	5	"
	10	lb.

120. Fig Fondant

Peppermint Oil	1/32	dr.
Peach Flavor Oil	5	"
Raspberry Essence	½	lb.
Basic Fig Essence	9½	"
	10	lb.

121. Gooseberry Fondant

Rose Oil	1/32	dr.
Safrol	1¼	"
Solution Orris Oil (10%)	4¾	"
Cumarin	6	"
Acetic Acid (80%)	12	"
Raspberry Essence	4½	oz.
Black Currant Essence	10	"
Basic Gooseberry Essence	9	lb.
	10	lb.

122. Grape Fondant

Black Currant Essence	½	lb.
Pineapple Essence	1½	"
Basic Grape Essence	8	"
	10	lb.

123. Muscatel Grape Fondant

Honey Flavor Oil	1 dr.
Carob Tincture	¼ lb.
Black Currant Essence	1¾ "
Basic Grape Essence	8 "
	10 lb.

124. Grenadine Fondant

Vanillin		1 dr.
Peach Flavor Oil		4 "
Alcohol	1 oz.	11 "
Strawberry Essence	2 "	
Raspberry Essence	5 "	
Pomegranate Juice	7 "	
	1 lb.	

125. Hazelnut Fondant

Rose Oil	⅛ dr.
Ceylon Cinnamon Oil	2⅜ "
Mace Oil	5½ "
Vanillin	6 "
Pimento Oil	10 "
Butyric Acid	1½ oz.
Peach Flavor Oil	1 "
Basic Hazelnut Essence	9¾ lb.
	10 lb.

126. Hip Fondant

Vanillin	2½ dr.
Rose Water	½ lb.
Basic Hip Essence	9½ "
	10 lb.

127. Honey Fondant

Ethyl Acetate	6 dr.
Honey Flavor Oil	6 "
Glycerin	12 "
Rose Water	1½ oz.
Malt Essence	2 "
Alcohol	11 "
	1 lb.

128. Ice Cream Fondant

Peach Essence	12 dr.
Lemon Essence	1¼ oz.
Strawberry Essence	2 "
Rum Essence	2 "
Hazelnut Essence	4 "
Walnut Essence	6 "
	1 lb.

129. Cola Nut Fondant

Cumarin	1¼ dr.
Heliotropin	3¾ "
Alcohol	11 "
Rum, Genuine	15 oz.
Brown Cacao Essence	2 lb.
Cola Nut Essence	3 "
Orange Essence	4 "
	10 lb.

130. Lemon Fondant

Lemon Extract Essence	2 lb.
Lemon Distillate	3 "
Proof Spirit	5 "
	10 lb.

131. Lemon Spice Fondant

Spice Fondant	4 lb.
Lemon Fondant Essence	6 "
	10 lb.

132. Lime Fondant

Orange Essence	½ lb.
Lemon Essence	½ "
Limetta Essence	4 "
Proof Spirit	5 "
	10 lb.

133. Macaroon Fondant

Rose Oil	$\frac{1}{32}$ dr.
Peach Flavor Oil	6 "
Mace Tincture	10 "
Alcohol	2 oz.
Brown Coffee Essence	13 "
Peach Essence	1 lb.
Brown Cacao Essence	1½ "
Orange Essence	1½ "
Cherry Brandy Essence	2 "
Hazelnut Basic Essence	3 "
	10 lb.

134. Melon Fondant

Vanillin	6 dr.
Lemon Essence	½ lb.
Orange Flower Water	½ "
Orange Essence	1 "
Melon Basic Essence	8 "
	10 lb.

135. Mirabelle Fondant

Peppermint Oil	$\frac{1}{32}$ dr.	
Benzaldehyde	5 "	
Vanillin	7 "	
Peach Flavor Oil	1¼ oz.	
Pineapple Essence	1 lb.	14 oz.
Mirabelle Basic Essence	8 "	
	10 lb.	

136. Morelle Fondant

Benzaldehyde	4 dr.	
Cumarin	4 "	
Vanillin	8 "	
Cherry Basic Essence	9 lb.	15 oz.
	10 lb.	

137. Mouthpearl Fondant

Peppermint Oil	5 dr.	
Thymol	5 "	
Eucalyptol	6 "	
Musk Tincture (1:50)	2 oz.	
Lemon Essence	1 lb.	4 oz.
Orange Essence	2 "	
Strawberry Essence	2 "	
Peach Essence	4 "	9 "
	10 lb.	

138. Mulberry Fondant

Orris Oil Solution (1 : 100)	2½ dr.
Heliotropin	2 oz.
Lemon Essence	14 "
Black Currant Essence	1½ lb.
Mulberry Essence	7½ "
	10 lb.

139. Nectar Fondant

Peach Flavor Oil	½ dr.
Vanillin	½ "
Honey Flavor Oil	3 "
Rum, Genuine	12 "
Malt Essence	3 oz.
Alcohol	6 "
Grape Essence	6 "
	1 lb.

140. Nectarine Fondant

Vanillin	1¼ dr.	
Peach Flavor Oil	3¾ "	
Apricot Essence	6 oz.	11 dr.
Wild Strawberry Essence	9 "	
	1 lb.	

141. Nougat Fondant

Vanillin	1½ dr.
Benzaldehyde	2½ "
Butyric Acid (100%)	6 "
Rum, Genuine	6 "
Hazelnut Essence	3 oz.
Brown Coffee Essence	3 "
Brown Cacao Essence	9 "
	1 lb.

142. Bitter Orange Fondant

Bitter Orange Fruit Tincture	1 lb.
Bitter Orange Extract Essence	2 "
Bitter Orange Distillate	3 "
Proof Spirit	4 "
	10 lb.

143. Sweet Orange Fondant

Sweet Orange Extract Essence	2 lb.
Sweet Orange Distillate	3 "
Proof Spirit	5 "
	10 lb.

144. Orgeat Fondant

(Filler for fine fondants and pralines, to protect them from drying out; also known as Bitter Almond Milk Extract — used in proportion of 5 : 100)

Vanillin	½ oz.
Benzaldehyde	½ "
Alcohol	2 "
Rose Water	5 "
Cherry Laurel Water	½ lb.
Condensed Milk	9 "

The taste may be varied by means of fruit essences, of which 1 lb. of the desired essence may be added tc 10 lb. of the above mixture.

145. Orris Fondant

Lemon Oil, Terpeneless	¼ oz.
Orris Oil Solution (1 : 100)	3¾ "
Orris Basic Essence	9¾ lb.
	10 lb.

146. Peach Fondant

Vanillin	2½ dr.
Orris Oil Solution (1%)	2½ "
Peach Flavor Oil	11 "
Cherry Laurel Water	7 oz.
Peach Basic Essence	9½ lb.
	10 lb.

147. Pear Fondant

Ceylon Cinnamon Oil	2½ dr.
Cumarin	3½ "
Vanillin	6 "
Lemon Essence	7¼ oz.
Black Currant Essence	½ lb.
Pear Basic Essence	9 "
	10 lb.

148. Pineapple Fondant

Butyric Acid	2½ dr.
Vanillin	13½ "
Alcohol	3 oz.
Lemon Essence	¼ lb.
Pineapple Basic Essence	9½ "
	10 lb.

149. Pistachio Nut Fondant

Cognac Oil	1 dr.
Benzaldehyde	6 "
Vanillin	9 "
Peach Flavor Oil	3 oz.
Butyric Acid (100%)	4 "
Pistachio Basic Essence	9½ lb.
	10 lb.

150. Plum Fondant

Clove Oil	½ oz.
Ceylon Cinnamon Oil	1½ "
Coriander Oil	1½ "
Rum Essence	1½ "
Benzaldehyde	3 "
Plum Basic Essence	9½ lb.
	10 lb.

151. Prunelle Fondant

Orris Oil Solution (1 : 100)	4 dr.
Peach Flavor Oil	4 "
Rum Essence	6 "
Cherry Laurel Water	7 oz.
Brown Cacao Essence	8 "
Prunelle Basic Essence	9 lb.
	10 lb.

152. Quince Fondant

Benzaldehyde	2½ dr.
Cumarin	3½ "
Pineapple Essence	2 lb.
Quince Basic Essence	8 "
	10 lb.

153. Raspberry Fondant

Rose Oil	1/32 dr.
Jasmine Oil Solution (10%)	⅛ "
Orris Oil Solution (10%)	½ oz.
Vanillin	½ "
Currant Essence	7 "
Raspberry Essence	9½ lb.
	10 lb.

Note: If a colorless essence is desired, the colorless distillates are used instead of the respective fruit essences.

154. Green Gage Fondant

Clove Oil	2½ dr.
Cumarin	5½ "
Rum, Genuine	½ lb.
Black Currant Essence	1½ "
Green Gage Basic Essence	8 "
	10 lb.

155. Spice Fondant

Vanillin	1 dr.
Benzaldehyde	2 "
Lemon Essence	5 "
Cardamom Tincture	1½ oz.
Clove Tincture	4 "
Cherry Brandy Tincture	4 "
Cinnamon Tincture	6 "
	1 lb.

156. STRAWBERRY FONDANT
(From Cultivated Berries)

Cumarin	2½ dr.
Nerolin	3½ "
Benzyl Acetate	10 "
Alcohol	3 oz.
Pineapple Essence	12 "
Strawberry Essence	9 lb.
	10 lb.

157. STRAWBERRY FONDANT
(From Wild Berries)

Nerolin	3½ dr.
Cumarin	3½ "
Benzoyl Benzoate	9 "
Benzyl Acetate	2 oz.
Alcohol	5 "
Wild Strawberry Essence	9½ lb.
	10 lb.

158. TANGERINE FONDANT

Mandarin Essence	2 lb.
Orange Essence	3 "
Proof Spirit	5 "
	10 lb.

159. WALNUT FONDANT

Benzaldehyde	4½ dr.
Mace Oil	5½ "
Vanillin	6 "
Lemon Essence	1 oz.
Butyric Acid (100%)	1 "
Peach Flavor Oil	1 "
Walnut Basic Essence	9¾ lb.
	10 lb.

160. WOODRUFF FONDANT

Clove Oil	2 dr.
Cumarin	6 "
Rose Water	1½ oz.
Tonka Tincture	5 "
Vanilla Essence	3 "
Proof Spirit	6 "
	1 lb.

WINE FONDANT FLAVORS

161. BURGUNDY FONDANT

Ambergris Tincture	½ oz.
Rhatany Tincture	3½ "
Cherry Juice	4 "
Raspberry Essence	8 "
Black Currant Essence	1 lb.
Grape Essence	8 "
	10 lb.

162. CLARET FONDANT

Civet Tincture	½ oz.
Ambergris Tincture	½ "
Rhatany Tincture	7 "
Black Currant Essence	1 lb.
Cherry Juice	2 "
Grape Essence (from red raisins)	6½ "
	10 lb.

163. MADEIRA FONDANT

Pineapple Essence	4 oz.
Brown Cacao Essence	8 "
Elder Flower Tincture	8 oz.
Black Currant Essence	12 "
Grape Essence	8 lb.
	10 lb.

164. MALAGA FONDANT

Civet Tincture	5 dr.
Ambergris Tincture	5 "
Vanillin	5 "
Cherry Water, Genuine	9 "
Rhatany Tincture	6½ oz.
Black Currant Essence	1 lb.
Carob Tincture	1 "
Grape Essence	7½ "
	10 lb.

165. MUSCATEL ESSENCE

Cumarin	¼ oz.
Mace Tincture	1¾ "
Elder Flower Essence	6 "
Apple Essence	1½ lb.
Grape Essence	8 "
	10 lb.

166. Port Fondant

Vanillin	¼ oz.
Ambergris Tincture	¼ "
Brown Cacao Essence	7½ "
Rhatany Tincture	8 "
Grape Essence	9 lb.
	10 lb.

167. Rhine Wine Fondant

White Cognac Oil	2½ oz.
Heliotropin	3½ "
Ethyl Acetate	10 dr.
Apple Essence	1 lb. 7 oz.
Grape Essence	8½ "
	10 lb.

168. Sherry Fondant

Civet Tincture	¼ oz.
Elder Flower Tincture	2¾ "
Black Currant Essence	13 "
Pineapple Essence	1 lb.
Grape Essence	8 "
	10 lb.

169. Tokay Fondant

Civet Tincture	2½ dr.
Pineapple Essence	½ lb.
Raspberry Essence	½ "
Carob Tincture	1 "
Grape Essence	8 "
	10 lb.

V. ORIGINAL FRUIT ETHERS

(Foundations for Caramel Flavors [Fruit Spirits], Commercial Fruit Ethers and Wafer Flavors)

The following formulas only serve the purpose as intermediate products. They are composed chiefly of ethers which are flavored with volatile oils or odorous substances, and they are used for making artificial fruit ethers; and in conjunction with the natural basic essences described in Part III, also for making the so-called natural fruit ethers. But they are chiefly used for caramel essences, also known as fruit or bonbon spirits, for making which the methods are given in Part VI.

It is a basic requirement that the ethers serving as ingredients be absolutely pure and not diluted with alcohol; as these basic compounds are also used for making fat-soluble flavors for wafers, it is also very important that these compounds contain no water, otherwise turbidities will be caused.

The total weights afforded by the formulas here given vary between 6 and 10 lb., and the quantities are those calculated to afford 100 lb. of the subsequently made compound, be it fruit ether, caramel essence or wafer flavor.

170. Method of Making Artificial Fruit Ethers

Mix 70 parts by weight of strong alcohol, 5 parts by weight of glycerin, the final weight of basic ether obtained by the following formulas, and sufficient distilled water to make 100 parts by weight of total product.

171. Apricot Basic Ether

Jasmine Oil, True	⅛ dr.
Anethol	4 "
Eugenol	6 "
Petitgrain Oil	14 "
Amyl Alcohol	1½ oz.
Vanillin	3 "
Peach Flavor Oil	10 "
Ethyl Valerate	1 lb.
Ethyl Acetate	1¼ "
Amyl Acetate	1½ "
Ethyl Butyrate	1½ "
Butyl Butyrate	1¾ "
	8 lb.

172. Apple Basic Ether

Cognac Oil, White	¾ oz.
Benzaldehyde	1 "
Clove Oil	3 "
Ethyl Œnanthate	11¼ "
Ethyl Butyrate	1 lb.
Amyl Acetate	1½ "
Amyl Valerate	1½ "
Ethyl Valerate	2 "
Ethyl Acetate	3 "
	10 lb.

173. Banana Basic Ether

Chamomile Oil	2½ dr.
Ceylon Cinnamon Oil	5½ "
Eugenol	8 "
Petitgrain Oil	1½ oz.
Mandarin Oil	2 "
Vanillin	3 "
Benzyl Benzoate	4 "
Sweet Orange Oil	4½ "
Lemon Oil	½ lb.
Ethyl Sebacate	½ "
Amyl Acetate	1¾ "
Ethyl Butyrate	2¼ "
Amyl Butyrate	4 "
	10 lb.

174. Barberry Basic Ether

Ceylon Cinnamon Oil	4 dr.
Petitgrain Oil	4 "
Heliotropin	6 "
Cumarin	10 dr.
Benzyl Acetate	6½ oz.
Sweet Orange Oil	½ lb.
Isobutyl Acetate	1¼ "
Ethyl Acetate	1½ "
Amyl Valerate	2¼ "
	6 lb.

175. Black Bilberry Basic Ether

Coriander Oil	6 dr.
Fennel Oil	18 "
Amyl Butyrate	14½ oz.
Amyl Acetate	1½ lb.
Ethyl Benzoate	2 "
Ethyl Acetate	2½ "
	7 lb.

176. Red Bilberry Basic Ether

Methyl Salicylate	6 dr.
Coriander Oil	6 "
Petitgrain Oil	12 "
Vanillin	3 oz.
Benzyl Acetate	3½ "
Ethyl Benzoate	8½ "
Amyl Acetate	1 lb.
Amyl Butyrate	1¼ "
Ethyl Valerate	1¼ "
Ethyl Acetate	2½ "
	7 lb.

177. Butterscotch Basic Ether

Ethyl Œnanthate	½ lb.
Ethyl Pelargonate	1 "
Butyl Butyrate	1¼ "
Amyl Acetate	1¼ "
Ethyl Butyrate	1½ "
Butyric Acid (100%)	2½ "
	8 lb.

Addition:

Ceylon Cinnamon Oil	1¼ dr.
Honey Flavor Oil	6 "

178. Cherry Basic Ether

Ceylon Cinnamon Oil	½ oz.
Cognac Oil	1½ "
Clove Oil	2 "
Benzyl Benzoate	2½ "
Vanillin	2½ "
Benzaldehyde	7 "
Amyl Alcohol	8 "
Ethyl Œnanthate	12 "
Amyl Formate	2¼ lb.
Ethyl Acetate	3½ "
	8 lb.

179. Cherry Brandy Basic Ether

Neroli Oil	⅛ dr.
Vanillin	12 "
Clove Oil	12 "
Cinnamon Oil	1 oz.
Cognac Oil	1½ "
Amyl Alcohol	1½ "
Benzaldehyde	4½ "
Ethyl Pelargonate	6 "
Benzyl Benzoate	½ lb.
Ethyl Œnanthate	1½ "
Ethyl Acetate	4 "
	7 lb.

180. Cacao Basic Ether

Clove Oil	3 oz.
Ceylon Cinnamon Oil	3 "
Vanillin	6 "
Benzyl Alcohol	8 "
Ethyl Œnanthate	12 "
Amyl Butyrate	1½ lb.
Amyl Acetate	2 "
Ethyl Acetate	2½ "
	8 lb.

181. Coffee Basic Ether

Neroli Oil	1¼ dr.
Cognac Oil	6¾ "
Vanillin	2½ oz.
Lemon Oil	4 "
Benzyl Benzoate	7 "
Ethyl Pelargonate	10 "
Ethyl Formate	1¼ lb.
Amyl Acetate	2 "
Ethyl Acetate	2¼ "
	7 lb.

182. Currant Basic Ether

Rose Oil	⅛ dr.
Ceylon Cinnamon Oil	6 "
Petitgrain Oil	6 "
Vanillin	1¼ "
Benzyl Acetate	4 "
Orris Oil Solution (1 : 100)	6 "
Sweet Orange Oil	1 lb.
Ethyl Acetate	1 "
Lemon Oil	1¼ "
Isobutyl Acetate	1½ "
Amyl Acetate	½ "
Amyl Butyrate	2 "
	9 lb.

183. Date Basic Ether

Honey Flavor Oil	6 dr.
Eugenol	6 "
Ceylon Cinnamon Oil	12 "
Peach Flavor Oil	2 oz.
Nerolin	2½ "
Amyl Butyrate	10 "
Ethyl Benzoate	1½ lb.
Amyl Valerate	1½ "
Amyl Acetate	2½ "
Ethyl Acetate	3½ "
	10 lb.

184. Gooseberry Basic Ether

Rose Oil	⅛ dr.
Safrol	12 "
Fennel Oil	1¼ oz.
Cumarin	4 "
Ethyl Benzoate	6 "
Amyl Acetate	2¼ lb.
Ethyl Butyrate	2¼ "
Ethyl Acetate	2¾ "
	8 lb.

185. Grape Basic Ether

Methyl Salicylate	1¼ dr.
Cognac Oil	4¾ "
Cardamom Oil	6 "
Mace Oil	12 "
Ethyl Pelargonate	3½ oz.
Amyl Butyrate	11 "
Ethyl Œnanthate	2½ lb.
Ethyl Acetate	4½ "
	8 lb.

186. Grenadine Basic Ether

Clove Oil	6 dr.
Honey Flavor Oil	12 "
Ceylon Cinnamon Oil	14 "
Nerolin	1½ oz.
Petitgrain Oil	2½ "
Benzoyl Benzoate	10 "
Peach Flavor Oil	¾ lb.
Amyl Valerate	1¼ "
Amyl Acetate	1½ "
Ethyl Acetate	3½ "
	8 lb.

187. Hip Basic Ether

Rose Oil	¼ dr.
Clove Oil	1¼ oz.
Anisaldehyde	1½ "
Heliotropin	1¾ "
Butyric Acid (100%)	3½ "
Amyl Butyrate	1¼ lb.
Ethyl Valerate	1¼ "
Amyl Acetate	2 "
Ethyl Acetate	3 "
	8 lb.

188. Honey Basic Ether

Pelargonic Ether	¼ lb.
Honey Flavor Oil	¼ "
Amyl Acetate	1½ "
Amyl Valerate	2 "
Acetate Ethyl	4 "
	8 lb.

189. Hop Basic Ether

Ceylon Cinnamon Oil	10 dr.
Hop Oil, Terpeneless (10% solution)	14 "
Clove Oil	2½ oz.
Petitgrain Oil	3 "
Sweet Orange Oil	3 "
Ethyl Pelargonate	6 "
Ethyl Œnanthate	1¼ lb.
Amyl Butyrate	1¼ "
Amyl Acetate	1½ "
Ethyl Acetate	5 "
	10 lb.

190. Ginger Basic Ether

Galanga Oil	¾ oz.
Clove	3¼ "
Cardamom Oil	4 "
Petitgrain Oil	4 "
Ginger Oil	1 lb.
Ethyl Œnanthate	1¼ "
Amyl Butyrate	2 "
Ethyl Acetate	3 "
	8 lb.

191. Lemon Basic Ether

Sweet Orange Oil	1 lb.
Amyl Acetate	1 "
Ethyl Acetate	2 "
Amyl Butyrate	2½ "
Lemon Oil	3½ "
	10 lb.

192. Lime Basic Ether

Peppermint Oil	6 dr.
Amyl Butyrate	1½ lb.
Amyl Acetate	2 "
Lemon Oil	2 "
Lime Oil	2 "
Ethyl Acetate	2½ "
	10 lb.

193. Malt Basic Ether

Honey Flavor Oil	¾ oz.
Ginger Oil	1¼ "
Amyl Alcohol	1½ "
Sweet Orange Oil	3 "
Petitgrain Oil	6½ "
Ethyl Œnanthate	11 "
Ethyl Formate	1¾ lb.
Ethyl Acetate	3¾ "
	7 lb.

194. Melon Basic Ether

Vanillin	1½ oz.
Butyric Acid (100%)	1½ "
Lemon Oil	4 "
Ethyl Pelargonate	4 "
Amyl Acetate	13 "
Ethyl Acetate	1 lb.
Ethyl Valerate	1¼ "
Amyl Butyrate	1¼ "
Amyl Valerate	2 "
	7 lb.

195. Milk Caramel Basic Ether

Honey Flavor Oil	1½ dr.
Rose Geranium Oil	5¾ "
Cardamom Oil	12 "
Thymol	13 "
Ceylon Cinnamon Oil	2 oz.
Coriander Oil	2 "
Benzaldehyde	3 "
Amyl Butyrate	7 "
Butyric Acid (100%)	8 "
Ethyl Butyrate	2 lb.
Ethyl Acetate	2½ "
	6 lb.

196. Mirabelle Basic Ether

Geranium Oil	¾ oz.
Amyl Alcohol	1½ "
Lemon Oil	1¾ "
Ceylon Cinnamon Oil	1¾ "
Vanillin	2¼ "
Clove Oil	3¾ "
Benzaldehyde	8 "
Ethyl Formate	1¼ lb.
Ethyl Œnanthate	1½ "
Ethyl Butyrate	1¾ "
Ethyl Acetate	2¼ "
	8 lb.

197. Mulberry Basic Ether

Orris Oil Solution (1 : 100)	2½ dr.
Benzaldehyde	5½ "
Ethyl Pelargonate	1½ oz.
Ethyl Œnanthate	6 "
Benzyl Acetate	8 "
Ethyl Acetate	1½ lb.
Ethyl Formate	1½ "
Amyl Acetate	3½ "
	7 lb.

198. Bitter Orange Basic Ether

Pimenta Oil	1½ oz.
Petitgrain Oil	14½ "
Amyl Acetate	1 lb.
Ethyl Acetate	1½ "
Bitter Orange Oil	3 "
Amyl Butyrate	3½ "
	10 lb.

199. Sweet Orange Basic Ether

Lemon Oil	1 lb.
Amyl Acetate	1 "
Ethyl Acetate	1½ "
Sweet Orange Oil	3 "
Amyl Butyrate	3½ "
	10 lb.

200. Orris Basic Ether

Ionone (20%)	5 dr.
Coriander Oil	7 "
Cardamom Oil	12 "
Benzyl Alcohol	6½ oz.
Ethyl Pelargonate	8 "
Ethyl Œnanthate	1½ lb.
Amyl Butyrate	2 "
Ethyl Acetate	3½ "
	8 lb.

201. Peach Basic Ether

Petitgrain Oil	5 dr.
Pimenta Oil	6 "
Cardamom Oil	13 "
Sweet Orange Oil	2 oz.
Vanillin	2 "
Benzaldehyde	2½ "
Lemon Oil	4 "
Amyl Butyrate	4 "
Peach Flavor Oil	1 lb.
Ethyl Butyrate	1 "
Amyl Acetate	2½ "
Ethyl Acetate	2½ "
	8 lb.

202. Pear Basic Ether

Eugenol	¾	oz.
Petitgrain Oil	2¼	"
Vanillin	4	"
Bergamot Oil	9	"
Sweet Orange Oil	1	lb.
Ethyl Acetate	1¼	"
Amyl Acetate	4¾	"
	8	lb.

203. Pineapple Basic Ether

Vanillin	1¼	oz.
Lemon Oil	1½	"
Butyric Acid (100%)	1½	"
Ethyl Sebacate	1¾	"
Ethyl Pelargonate	4	"
Amyl Acetate	6	"
Ethyl Acetate	1¼	lb.
Ethyl Butyrate	3	"
Amyl Butyrate	4¾	"
	10	lb.

204. Pistachio Basic Ether

Mandarin Oil	1½	oz.
Benzyl Benzoate	1½	"
Butyric Acid	1½	"
Heliotropin	2½	"
Pimento Oil	4	"
Benzaldehyde	5	"
Peach Flavor Oil	½	lb.
Mace Oil	½	"
Sweet Orange Oil	½	"
Ethyl Œnanthate	1	"
Amyl Acetate	1	"
Ethyl Butyrate	1½	"
Ethyl Acetate	2	"
	8	lb.

205. Plum Basic Ether

Lemon Oil	2	oz.
Mandarin Oil	2	"
Clove Oil	3	"
Coriander Oil	3	"
Amyl Alcohol	6	"
Benzaldehyde	½	lb.
Ethyl Acetate	1	"
Ethyl Formate	1½	"
Amyl Formate	1¾	lb.
Amyl Butyrate	2¼	"
	8	lb.

206. Quince Basic Ether

Bergamot Oil	2½	dr.
Cognac Oil	7½	"
Benzaldehyde	14	"
Clove Oil	1½	oz.
Sweet Orange Oil	5	"
Ethyl Butyrate	8	"
Amyl Valerate	1½	lb.
Ethyl Valerate	2½	"
Amyl Acetate	3	"
	8	lb.

207. Raspberry Basic Ether

Rose Oil	⅛	dr.
Jasmin Oil (10%)	1⅛	"
Ceylon Cinnamon Oil	6¾	"
Clove Oil	12	"
Pettitgrain	12	"
Vanillin	3	oz.
Orris Oil Solution (10%)	5	"
Benzyl Benzoate	6	"
Ethyl Formate	½	lb
Ethyl Acetate	1½	"
Amyl Acetate	2	"
Isobutyl Acetate	3	"
	8	lb

208. Green Gage Basic Ether

Rose Oil	⅛	dr
Geranium Oil	6	"
Clove Oil	6	"
Ceylon Cinnamon Oil	10	"
Amyl Alcohol	12	"
Cognac Oil	12	"
Vanillin	14	"
Sweet Orange Oil	2¼	oz
Ethyl Pelargonate	3	"
Benzaldehyde	5	"
Benzyl Acetate	7	"
Ethyl Œnanthate	11	"
Ethyl Butyrate	1¼	lb
Amyl Butyrate	1¾	"
Ethyl Acetate	2	"
	7	lb

209. Strawberry Basic Ether
(From Cultivated Berries)

Cumarin	12	dr.
Ceylon Cinnamon Oil	12	"
Amyl Formate	4	oz.
Nerolin	4½	"
Ethyl Benzoate	6	"
Amyl Butyrate	½	lb.
Methyl Salicylate	½	"
Ethyl Butyrate	1	"
Ethyl Acetate	1	"
Benzyl Acetate	1½	"
Amyl Butyrate	1½	"
	7	lb.

210. Strawberry Basic Ether
(From Wild Berries)

Wintergreen Oil	6	dr.
Ceylon Cinnamon Oil	6	"
Vanillin	12	"
Cumarin	3½	oz.
Nerolin	5	"
Ethyl Benzoate	6	"
Methyl Salicylate	½	lb.
Ethyl Butyrate	½	"
Ethyl Acetate	1½	"
Benzyl Acetate	1½	"
Amyl Acetate	3	"
	8	lb.

211. Tangerine Basic Ether

Lemon Oil	1	lb.
Bitter Orange Oil	1	"
Amyl Acetate	1	"
Ethyl Acetate	1½	"
Mandarin Oil	2	"
Amyl Butyrate	3½	"
	10	lb.

212. Tea Basic Ether

Rose Oil	⅛	dr.
Neroli Oil	1⅛	"
Cognac Oil	6¾	"
Lemon Oil	1½	oz.
Vanillin	3	oz.
Benzyl Acetate	5	"
Ethyl Pelargonate	6	"
Ethyl Formate	1	lb.
Amyl Butyrate	2	"
Ethyl Acetate	3	"
	7	lb.

213. Vanilla Basic Ether

Cardamom Oil	1½	oz.
Cinnamon Oil	2½	"
Clove Oil	4	"
Ethyl Œnanthate	8	"
Vanillin	8	"
Amyl Acetate	1½	lb.
Ethyl Acetate	3	"
	6	lb.

214. Walnut Basic Ether

Cardamom Oil	½	oz.
Lemon Oil	1	"
Anisaldehyde	1½	"
Butyric Acid	1½	"
Clove Oil	2	"
Sweet Orange Oil	3½	"
Benzaldehyde	4	"
Vanillin	4	"
Lemon Oil	7	"
Mace Oil	7	"
Ethyl Œnanthate	1½	lb.
Amyl Valerate	1½	"
Ethyl Acetate	3	"
	8	lb.

215. Universal Basic Ether

This serves as a neutral ether base for flavoring compositions not particularly mentioned, or as a supplementary basic ether.

Amyl Butyrate	½	lb.
Ethyl Formate	1½	"
Amyl Acetate	1½	"
Ethyl Acetate	2½	"
	6	lb.

Special Formulas for Wafer-flavor Basic Ethers

The ethers employed in making these must be perfectly pure and anhydrous. They should be clearly miscible with paraffin oil, and when used with the fatty substances as detailed later they should afford perfect solutions.

216. Arrac Wafer

Ceylon Cinnamon Oil	6 dr.
Neroli Oil	6 "
Cumarin	12 "
Vanillin	1½ oz.
Cognac	2 "
Ethyl Butyrate	11 "
Ethyl Acetate	2 lb.
Ethyl Formate	3½ "
Sugar Ether	3½ "
	10 lb.

217. Bitter Almond Wafer

Ethyl Benzoate	½ lb.
Benzaldehyde	1 "
Amyl Acetate	1½ "
Ethyl Formate	2½ "
Ethyl Acetate	4½ "
	10 lb.

218. Cacao Wafer

Brown Cacao Essence	20 lb.
Amyl Acetate	2 "

Shake thoroughly, and until the flavoring has passed over into the amyl acetate; allow to stand for some time, then draw off the aromatized, supernatant amyl acetate layer, and filter it with the aid of infusorial earth. The residual dearomatized cacao essence may be distilled in order to recover the alcohol still present in it. To the amyl acetate filtered as described now add:

Cardamom Oil	8 dr.
Clove Oil	12 "
Ceylon Cinnamon Oil	2¼ oz.
Vanillin	4½ "
Benzyl Alcohol	8 "
Ethyl Œnanthate	¾ lb.
Amyl Butyrate	1½ lb.
Ethyl Acetate	2¾ "
	8 lb.

219. Chocolate Wafer

This is made in the same way as No. 218, by shaking out cacao essence with amyl acetate, but with the addition to 2 lb. of the amyl acetate extract of the following:

Cardamom Oil	8 dr.
Clove Oil	12 "
Ceylon Cinnamon Oil	1¾ oz.
Vanillin	5 "
Ethyl Butyrate	8 "
Ethyl Acetate	3 lb.
	6 lb.

220. Coffee Wafer

10 lb. of brown coffee essence are shaken out with 2 lb. amyl acetate, and to the latter, after its separation, the following are added:

Clove Oil	12 dr.
Vanillin	1¼ oz.
Lemon Oil	4 "
Benzyl Alcohol	6 "
Ethyl Pelargonate	¾ lb.
Ethyl Formate	1¼ "
Ethyl Acetate	2¼ "
	7 lb.

221. Cognac Wafer

Neroli Oil	⅛ dr.
Vanillin	6 "
Benzaldehyde	6 "
Cognac Oil	2¼ oz.
Pettitgrain Oil	5 "
Ethyl Pelargonate	8 "
Amyl Butyrate	8 "
Ethyl Œnanthate	1 lb.
Amyl Acetate	3½ "
Ethyl Acetate	4 "
	10 lb.

222. Cream Wafer

Honey Flavor Oil	½	dr.
Peach Flavor Oil	4½	"
Rose Geranium Oil	7	"
Cardamom Oil	8	"
Cinnamon Oil	12	"
Coriander Oil	1	oz.
Benzaldehyde	1½	"
Vanillin	1½	"
Ethyl Pelargonate	4	"
Ethyl Œnanthate	6	"
Butyric Acid	1	lb
Amyl Acetate	1¼	"
Ethyl Acetate	1¾	"
	5	lb.

223. Curaçao Wafer

Rose Oil	2½	dr.
Coriander Oil	2	oz.
Ginger Oil	2½	"
Benzaldehyde	3½	"
Cinnamon Oil	4	"
Clove Oil	4	"
Pettitgrain Oil	8	"
Bitter Orange Oil	1	lb.
Amyl Valerate	1	"
Amyl Butyrate	1½	"
Ethyl Acetate	3	"
	8	lb.

224. English Wafer

Clove Oil	6	dr.
Heliotropin	6	"
Nerolin	12	"
Peach Flavor Oil	2	oz.
Vanillin	2½	"
Benzyl Acetate	10	"
Raspberry Flavor Oil	1	lb.
Ethyl Œnanthate	1¼	lb.
Amyl Acetate	1½	"
Ethyl Butyrate	2¼	"
	7	lb.

225. Ice Cream Wafer

Vanillin	½	oz.
Peach Basic Ether	1	lb.
Lemon Basic Ether	2½	"
Strawberry Basic Ether	2½	lb.
Nut Basic Ether	9½	"
	1	lb.

226. Maraschino Wafer

Rose Oil	2½	dr.
Clove Oil	4½	"
Neroli Oil	5	"
Ceylon Cinnamon Oil	3¼	"
Benzaldehyde	4	"
Lemon Oil	4	"
Raspberry Flavor Oil	½	lb.
Bitter Orange Oil	¾	"
Ethyl Sebacate	1	"
Amyl Formate	1½	"
Amyl Butyrate	2	"
Ethyl Acetate	3½	"
	10	lb.

227. Nectar Wafer

Methyl Salicylate	1¼	dr.
Cognac Oil	4¾	"
Cardamom Oil	6	"
Mace Oil	12	"
Honey Flavor Oil	4½	oz.
Ethyl Pelargonate	6	"
Ethyl Œnanthate	1¼	lb.
Ethyl Valerate	2	"
Ethyl Acetate	2	"
	6	lb.

228. Nougat Wafer

Exhaust 10 kilos brown cacao essence by shaking with 2 lb. amyl acetate as already described, and to the amyl acetate then add:

Clove Oil	2½	oz.
Cinnamon Oil	2½	"
Benzaldehyde	4	"
Butyric Acid	4	"
Vanillin	9	"
Benzyl Benzoate	12	"
Ethyl Œnanthate	14	"
Ethyl Butyrate	1	lb.
Amyl Butyrate	1½	"
Ethyl Acetate	2½	"
	8	lb.

229. Punch Wafer

Vanillin	2½	dr.
Peru Balsam	1½	oz.
Clove Oil	2	"
Ethyl Pelargonate	2½	"
Ceylon Cinnamon Oil	4	"
Sweet Orange Oil	6	"
Lemon Oil	1	lb.
Ethyl Acetate	1¼	"
Ethyl Formate	1¼	"
Ethyl Butyrate	3	"
	8	lb.

230. Rum Wafer

Birch Tar Oil	1¼	dr.
Ceylon Cinnamon Oil	2¾	"
Cognac Oil	4	"
Clove Oil	8	"
Lemon Oil	1½	oz.
Benzaldehyde	2½	"
Peru Balsam	4	"
Ethyl Œnanthate	7	"
Ethyl Pelargonate	1	lb.
Ethyl Butyrate	1½	"
Ethyl Acetate	2½	"
Ethyl Formate	4	"
	10	lb.

231. Woodruff Wafer

Vanillin	1	oz.
Cumarin	10	"
Benzyl Benzoate	10	"
Ethyl Pelargonate	11	"
Ethyl Œnanthate	1¼	lb.
Amyl Butyrate	1¾	"
Ethyl Acetate	2	"
	7	lb.

VI. CARAMEL FLAVORS (FRUIT OR BONBON SPIRITS)

232. Anisette

Universal Basic Ether		14 oz.
Anisette Essence	4 lb.	2 "
Proof Spirit	5 "	
	10 lb.	

233. Apricot

Apricot Basic Ether		13½ oz.
Apricot Essence	4 lb.	
Proof Spirit	5 "	2½ "
	10 lb.	

234. Apple

Apple Basic Ether		13½ oz.
Orange Essence		13½ "
Apple Essence	4 lb.	
Proof Spirit	4 "	5 "
	10 lb.	

235. Arrac

Cinnamon Oil	1/16	dr.
Cumarin	3/16	"
Cognac Oil	¼	"
Heliotropin	¼	"
Orange Flower Water	¾	"
Ethyl Formate	2¼	"
Ethyl Nitrite	2¼	"
Arrac, Genuine	4	dr.
Ethyl Formate	6¾	"
	1	lb.

236. Banana

Orange Essence	2	oz.
Orange Flower Water	2	"
Lemon Essence	4	"
Banana Basic Ether	1	lb.
Banana Essence	3	"
Proof Spirit	5½	"
	10	lb.

237. Benedictine

Neutral Basic Ether		10 oz.
Benedictine Essence	4 lb.	6 "
Proof Spirit	5 "	
	10 lb.	

238. Barberry

Heliotropin		1 dr.
Cumarin		4 "
Raspberry Essence		¾ oz.
Currant Essence		3 "
Lemon Essence		10 "
Barberry Basic Ether		10 "
Barberry Essence	3½ lb.	
Proof Spirit	5 "	14 "
	10 lb.	

239. Huckleberry

Heliotropin	2½ dr.
Cumarin	5½ "
Currant Essence	15½ oz.
Huckleberry Basic Ether	12 "
Huckleberry Essence	3½ lb.
Proof Spirit	4¾ "
	10 lb.

240. Red Bilberry

Heliotropin	2½ dr.
Cumarin	5½ "
Strawberry Essence	7½ oz.
Red Bilberry Basic Ether	12 "
Red Bilberry Essence	3¾ lb.
Proof Spirit	5 "
	10 lb.

241. Bitter Almond

Bitter Almond Basic Ether	1 lb.
Cherry Laurel Water	2 "
Proof Spirit	7 "
	10 lb.

242. Blackberry

Raspberry Essence	4 oz.
Currant Essence	4 "
Lemon Essence	12 "
Blackberry Basic Ether	12 "
Blackberry Essence	3 lb.
Proof Spirit	5 "
	10 lb.

243. Butterscotch

Butterscotch Basic Ether		13½ oz.
Glycerin	1 lb.	2½ "
Proof Spirit	8 "	
	10 lb.	

244. Champagne

Benzaldehyde	6 dr.
Heliotropin	6 "
Currant Essence	4½ oz.
Apple Essence	11 "
Grape Basic Ether	12 "
Grape Essence	3½ lb.
Proof Spirit	5 "
	10 lb.

245. Chartreuse

Neutral Basic Ether		10 oz.
Chartreuse Essence	4 lb.	6 "
Proof Spirit	5 "	
	10 lb.	

246. Red Cherry

Cherry Basic Ether		13½ oz.
Cherry Essence	4 lb.	2½ "
Proof Spirit	5 "	
	10 lb.	

247. White Cherry

Benzaldehyde		3½ dr.
Cumarin		4½ "
Cherry Basic Ether		13½ oz.
White Cherry Essence	4 lb.	2 "
Proof Spirit	5 "	
	10 lb.	

248. Cherry Brandy

Clove Oil		3 dr.
Cinnamon Oil		5 "
Benzaldehyde		8 "
Cherry Brandy Basic Ether		12 oz.
Proof Spirit	2 lb.	3 "
Cherry Essence	3 "	
Cherry Water, Genuine	4 "	
	10 lb.	

249. Cherry Spice

Lemon Oil, Terpeneless	1¼ dr.
Cognac Oil	2¾ "
Vanillin	12 "
Benzaldehyde	1½ oz.
Cherry Basic Ether	13½ "
Cherry Essence	4 lb.
Proof Spirit	5 "
	10 lb.

250. Chocolate

Cacao Basic Ether		13½ oz.
Proof Spirit	3 lb.	2½ "
Chocolate Fondant Essence	6 "	
	10 lb.	

251. Cacao

Cacao Basic Ether...		13½ oz.
Cacao Essence......	4 lb.	2½ "
Proof Spirit........	5 "	
	10 lb.	

252. Cocoanut

Benzaldehyde.......		5 dr.
Mace Oil..........		7 "
Clove Oil..........		12 "
Sweet Orange Oil....		2¼ oz.
Butyric Acid.......		4¼ "
Walnut Basic Ether.		13½ "
Cocoanut Essence...	4 lb.	10½ "
Proof Spirit........	4 "	
	10 lb.	

253. Coffee

Coffee Basic Ether..		13½ oz.
Coffee Essence......	4 lb.	2½ "
Proof Spirit........	5 "	
	10 lb.	

254. Cognac

Vanillin................	¼ dr.
Cognac Oil.............	3¾ "
Ethyl Nitrite...........	8 "
Rose Water............	12 "
Ethyl Acetate..........	1½ oz.
Ethyl Œnanthate........	1½ "
Proof Spirit............	5 "
Wine Distillate..........	6½ "
	1 lb.

255. Curaçao

Universal Basic Ether		10 oz.
Curaçao Essence....	4 lb.	6 "
Proof Spirit........	5 "	
	10 lb.	

256. Black Currant

Nerolin................	2½ dr.
Vanillin................	5½ "
Currant Basic Ether......	15½ oz.
Black Currant Essence....	4 lb.
Proof Spirit............	5 "
	10 lb.

257. Red Currant

Vanillin.................	8 dr.
Currant Basic Ether......	15½ oz.
Black Currant Essence....	4 lb.
Proof Spirit............	5 "
	10 lb.

258. Date

Peppermint Oil..........	¼ dr.
Calamus Oil.............	1 "
Benzaldehyde...........	2¾ "
Vanillin................	12 "
Pineapple Essence........	3 oz.
Date Basic Ether........	1 lb.
Date Essence	3¾ "
Proof Spirit...........	5 "
	10 lb.

259. Eucalyptus

Neutral Basic Ether.		10 oz.
Eucalyptus Essence..	4 lb.	6 "
Proof Spirit........	5 "	
	10 lb.	

260. Fig

Peppermint Oil..........	¼ dr.
Peach Flavor Oil.........	4¾ "
Vanillin................	7 "
Raspberry Essence.......	3¼ oz.
Date Basic Ether........	1 lb.
Fig Essence............	3¾ "
Proof Spirit............	5 "
	10 lb.

261. Gooseberry

Orris Oil Solution (1 : 100).........		2½ dr.
Raspberry Essence..		1½ "
Currant Essence....		6½ "
Gooseberry Basic Ether............		13½ "
Gooseberry Essence .	3 lb.	10½ oz.
Proof Spirit........	5 "	
	10 lb.	

262. Grape

Currant Essence	8	oz.
Apple Essence	10½	"
Grape Basic Ether	13½	"
Grape Essence	3	lb.
Proof Spirit	5	"
	10	lb.

263. Grape
(Muscatel)

Currant Essence	8	oz.
Pineapple Essence	10½	"
Grape Basic Ether	13½	"
Grape Essence	3	lb.
Proof Spirit	5	"
	10	lb.

264. Grenadine

Vanillin	8	dr.
Strawberry Essence	9½	oz.
Grenadine Basic Ether	10	"
Raspberry Essence	1¼	lb.
Peach Essence	1½	"
Proof Spirit	6	"
	10	lb.

265. Hazelnut

Rose Oil	⅛	dr.
Ceylon Cinnamon Oil	2½	"
Mace Oil	5½	"
Vanillin	6	"
Benzaldehyde	10	"
Butyric Acid	1½	oz.
Peach Flavor Oil	3½	"
Nut Basic Ether	13½	"
Hazelnut Essence	3¾	lb.
Proof Spirit	5	"
	10	lb.

266. Hips

Vanillin	8	dr.
Apricot Essence	4	oz.
Apple Essence	10	"
Hips Basic Ether	13½	"
Hips Essence	3¼	"
Proof Spirit	5	lb.
	10	lb.

267. Honey

Honey Flavor Oil	4	dr.
Raspberry Essence	8½	oz.
Rose Water	9¾	"
Honey Basic Ether	13½	"
Glycerin	2	lb.
Alcohol	6	"
	10	lb.

268. Hop

Hop Oil, Terpeneless (1:10)	⅛	dr.
Cumarin	7⅞	"
Apple Essence	5½	oz.
Hop Basic Ether	10	"
Hop Essence	4	lb.
Alcohol	5	"
	10	lb.

269. Cola Nut

Vanillin	1¼	dr.
Cumarin	2¾	"
Ethyl Formate	10¼	"
Cacao Basic Ether	13½	"
Cacao Essence	1	lb.
Sweet Orange Essence	1½	"
Cola Nut Essence	2	"
Proof Spirit	4	"
	10	lb.

270. Lemon

Lemon Basic Ether	1	lb.
Lemon Essence	4	"
Proof Spirit	5	"
	10	lb.

271. Lime

Lime Basic Ether	1	lb.
Lime Essence	4	"
Proof Spirit	5	"
	10	lb.

272. Malt

Honey Flavor Oil	1	dr.
Malt Basic Ether	¾	lb.
Malt Essence	4¼	"
Proof Spirit	5	"
	10	lb.

273. Maraschino

Universal Basic Ether	10 oz.
Maraschino Essence.	4 lb. 6 "
Proof Spirit........	5 "
	10 lb.

274. Melon

Vanillin................	8 dr.
Sweet Orange Essence....	3½ oz.
Melon Basic Ether.......	12 "
Melon Essence...........	4 lb.
Proof Spirit............	5 "
	10 lb.

275. Milk Caramel

Milk Caramel Basic Ether...........	10 oz.
Hazelnut Essence...	1 lb. 6 "
Glycerin...........	2 "
Proof Spirit........	6 "
	10 lb.

276. Mirabelle

Vanillin................	½ dr.
Benzaldehyde...........	4¾ "
Peach Flavor Oil.........	7 "
Vanillin................	1¼ oz.
Pineapple Essence........	8½ "
Mirabelle Basic Ether....	13½ "
Mirabelle Essence........	3½ lb.
Proof Spirit............	5 "
	10 lb.

277. Mulberry

Orris Oil (1 : 100)...	2½ dr.
Heliotropin.........	5½ "
Mulberry Basic Ether	12½ oz.
Mulberry Essence...	4 lb. 3 "
Proof Spirit........	5 "
	10 lb.

278. Nectar

Peach Flavor Oil....	2½ dr.
Vanillin............	5½ "
Rum Essence.......	7½ oz.
Malt Essence.......	8 "
Honey Basic Ether..	10 "
Grape Essence......	3 lb. 6 "
Proof Spirit........	5 "
	10 lb.

279. Nectarine

Peach Flavor Oil....	3 dr.
Vanillin............	5 "
Peach Basic Ether...	13½ oz.
Peach Essence......	1 lb. 10 "
Strawberry Essence.	2½ lb.
Proof Spirit........	5 "
	10 lb.

280. Nougat

Vanillin................	6 dr.
Benzaldehyde............	10 "
Butyric Acid............	2½ oz.
Coffee Essence...........	4½ "
Cacao Basic Ether.......	1½ lb.
Hazelnut Essence........	4 "
Proof Spirit............	4 "
	10 lb.

281. Bitter Orange

Lemon Essence..........	½ lb.
Bitter Orange Fruit Tincture..................	½ "
Bitter Orange Basic Ether.	1 "
Sweet Orange Essence....	3 "
Proof Spirit............	5 "
	10 lb.

282. Sweet Orange

Sweet Orange Basic Ether..	1 lb.
Sweet Orange Essence....	4 "
Proof Spirit............	5 "
	10 lb.

283. Orris

Orris Oil (1 : 100)...	$\frac{1}{16}$ dr.
Lemon Oil.........	½ "
Orris Basic Ether...	13½ oz.
Orris Essence.......	4 lb. 2½ "
Proof Spirit........	5 "
	10 lb.

284. Peach

Orris Oil (1 : 100)........	2½ dr.
Vanillin................	5½ "
Apple Essence...........	2 oz.
Peach Basic Ether.......	13½ "
Peach Essence...........	4 lb.
Proof Spirit............	5 "
	10 lb.

285. Pear

Bergamot Oil	3½ dr.
Cumarin	4½ "
Vanillin	8 "
Lemon Essence	4 oz.
Currant Essence	5½ "
Pear Basic Ether	13½ "
Pear Essence	3 lb.
Proof Spirit	5 "
	10 lb.

286. Persico

Almond Basic Ether	1 lb.
Persico Essence	4 "
Proof Spirit	5 "
	10 lb.

287. Pineapple

Pineapple Basic Ether	1 lb.
Pineapple Essence	4 "
Proof Spirit	5 "
	10 lb.

288. Pine Needle

Universal Basic Ether		10 oz.
Pine Needle Essence	4 lb.	6 "
Proof Spirit	5 "	
	10 lb.	

289. Pistachio Nut

Cognac Oil	1¼ dr.
Benzaldehyde	4¾ "
Vanillin	6 "
Butyric Acid (100%)	1¼ oz.
Peach Flavor Oil	4½ "
Pistachio Basic Ether	13½ "
Pistachio Essence	3¾ lb.
Proof Spirit	5 "
	10 lb.

290. Plum

Heliotropin		8 dr.
Plum Basic Ether		13½ oz.
Plum Essence	4 lb.	2 "
Proof Spirit	5 "	
	10 lb.	

291. Prunelle

Orris Oil (1 : 100)	2½ dr.
Peach Flavor Oil	5½ "
Vanillin	8 "
Cacao Essence	3 oz.
Rum Essence	6½ "
Mirabelle Basic Ether	13½ "
Prunelle Essence	3½ lb.
Proof Spirit	5 "
	10 lb.

292. Punch

Pineapple Essence		2½ oz.
Sweet Orange Essence		3½ "
Lemon Essence		4 "
Rum Essence	4 lb.	6 "
Proof Spirit	5 "	
	10 lb.	

293. Quince

Benzaldehyde	2½ dr.
Vanillin	5½ "
Pineapple Essence	10 "
Quince Basic Ether	13½ oz.
Quince Essence	3½ lb.
Proof Spirit	5 "
	10 lb.

294. Quodlibet

Peppermint Oil	4 dr.
Heliotropin	4 "
Raspberry Essence	7½ oz.
Lemon Essence	8 "
Pear Essence	1 lb.
Strawberry Essence	2 "
Proof Spirit	5 "
	10 lb.

295. Raspberry

Currant Essence	6½ oz.
Raspberry Basic Ether	13½ "
Raspberry Essence	3¾ lb.
Proof Spirit	5 "
	10 lb.

296. Ratafia

Nerolin	1¼ dr.
Vanillin	6¾ "
Raspberry Essence	3 oz.
Strawberry Essence	7 "
Sweet Orange Essence	13½ "
Universal Basic Ether	1 lb.
Lemon Essence	2½ "
Proof Spirit	5 "
	10 lb.

297. Green Gage

Eugenol	4 dr.
Cumarin	4 "
Currant Essence	7½ oz.
Green Gage Basic Ether	12½ "
Green Gage Essence	3¾ lb.
Proof Spirit	5 "
	10 lb.

298. Rock Drops

Peppermint Oil	1¼ dr.
Peach Flavor Oil	6¾ "
Rum Essence	7½ oz.
Sweet Orange Essence	12 "
Lemon Essence	12 "
Pineapple Essence	2 lb.
Universal Basic Ether	2 "
Proof Spirit	4 "
	10 lb.

299. Rum

Birch Tar Oil	1/32 dr.
Lemon Oil	1/16 "
Peru Balsam	2½ "
Vanillin	2½ "
Ethyl Butyrate	7 "
Ethyl Acetate	12 "
Ethyl Formate	7½ oz.
Rum, Genuine	7 "
	1 lb.

300. Swedish Punch

Rum Caramel Essence	12 dr.
Arrac, Genuine	12 "
Lemon Essence	4½ oz.
Arrac Caramel Essence	10 "
	1 lb.

301. Strawberry (Domestic)

Domestic Strawberry Basic Ether	¾ lb.
Domestic Strawberry Essence	4¼ "
Proof Spirit	5 "
	10 lb.

302. Strawberry (Wild)

Wild Strawberry Basic Ether	13½ oz.
Wild Strawberry Essence	4 lb. 2½ "
Proof Spirit	5 "
	10 lb.

303. Tangerine

Sweet Orange Basic Ether	1 lb.
Sweet Orange Essence	4 "
Proof Spirit	5 "
	10 lb.

304. Tea

Vanillin	8 dr.
Pineapple Essence	7½ oz.
Lemon Essence	8 "
Tea Basic Ether	10 "
Tea Essence	3 lb. 6 "
Proof Spirit	5 "
	10 lb.

305. Universal Caramel Essence

(Used for rinsing out the tin boxes for caramels.)

Bergamot Oil	1¼ dr.
Honey Flavor Oil	6¾ "
Peach Flavor Oil	8 "
Coriander Oil	8 "
Anise Oil	8 "
Sweet Orange Oil	6 oz.
Ethyl Butyrate	1 lb.
Ethyl Œnanthate	1¼ "
Amyl Acetate	3½ "
Amyl Butyrate	4 "
	10 lb.

306. Vanilla

Vanilla Basic Ether .	10 oz.
Vanilla Essence.....	4 lb. 6 "
Proof Spirit........	5 "
	10 lb.

307. Walnut

Benzaldehyde...........	4 dr.
Mace Oil...............	6 "
Vanillin...............	6 "
Lemon Oil..............	12 "
Butyric Acid (100%).....	1½ oz.
Peach Flavor Oil.........	2½ "
Nut Basic Ether.........	10½ oz.
Nut Essence.............	4 lb.
Proof Spirit.............	5 "
	10 lb.

308. Woodruff

Vanillin............	2½ dr.
Eugenol...........	5½ "
Cumarin...........	2½ oz.
Universal Basic Ether	10 "
Tonka Bean Tincture.............	1 lb. 3 "
Proof Spirit........	8 "
	10 lb.

VII. FAT-SOLUBLE WAFER FLAVORS

The flavoring for wafers has to be imparted to a vegetable fat, with which the butter mass which is to serve as a filter for the wafers is aromatized. For this purpose paraffin oil was generally used, but a vegetable oil, such as olive or sesame oil, is much better adapted. In making these flavors, the basic ether compounds, described in Part V, are dissolved according to the following table. In case a slight turbidity should occur, the preparation must be filtered warm with the aid of some infusorial earth. The wafer flavors are also marketed in a more consistent, or butter-like form, and in this case the base is a purified cocoanut butter, or also cacao butter, the mixture being effected with the basic ether on the water-bath, the fat being heated until just melted. If any coloring is desired, fat-soluble colors such as alkanin, chlorophyl, orlean, etc., may be used. The table gives the number of ounces of the basic ether compounds required to yield 10 lb. of finished wafer flavor; and the numbers refer to the formulas already given. The number of ounces mentioned are to be mixed with the fat it is desired to use, and the whole then made up to 10 lb.

309.	Apricot......	13½ oz.	No. 171
310.	Arrac........	1 lb.	No. 216
311.	Banana......	1 "	No. 173
312.	Bitter Almond	1 "	No. 217
313.	Cherry.......	13½ oz.	No. 178
314.	Chocolate....	10 "	No. 219
315.	Cacao........	13½ "	No. 218
316.	Coffee.......	12 "	No. 220
317.	Cognac......	1 lb.	No. 221
318.	Cream.......	10 oz.	No. 222
319.	Curaçao......	13½ "	No. 223
320.	Currant......	15 "	No. 182
321.	English Wafers	12 "	No. 224
322.	Ice Cream....	1 lb.	No. 225
323.	Lemon.......	1 "	No. 191
324.	Nectar.......	10 oz.	No. 227

325.	Nougat......	13½ oz.	No. 228	332.	Raspberry....	13½ oz.	No. 207
326.	Sweet Orange.	1 lb.	No. 199	333.	Rum.........	1 lb.	No. 230
327.	Peach........	13½ oz.	No. 201	334.	Strawberry...	12 oz.	No. 209
328.	Pear.........	13½ "	No. 202	335.	Tangerine....	1 lb.	No. 211
329.	Pineapple....	10 "	No. 203	336.	Vanilla.......	10 oz.	No. 213
330.	Pistachio.....	13½ "	No. 204	337.	Walnut......	13½ "	No. 214
331.	Punch.......	13½ "	No. 229	338.	Woodruff....	12 "	No. 231

VIII. FLOWER FLAVORS, GENUINE AND ARTIFICIAL — FOR FONDANTS, CARAMELS AND ETHERS

For making the so-called genuine essences of floral and flavoring substances, the French flower extracts, in the form of the quality known as "triple extracts," are employed, while for making the artificial substitutes the solutions of odorous substances are used. In any case, the odorous substances must be stabilized by means of suitable fixatives. The universal basic ether serves as a base for the floral ethers, and the fixative base consists of a violet type, which is adapted for use with cassie, orange flowers, roses and violets, while for elder flower, heliotrope, hyacinth, jasmine, mignonette and lily of the valley, an elder flower fixative base serves best.

339. Elder Flower Type Fixative Base

Macerate 1 lb. elder flowers with 4 pints of proof spirit for a week, and then work up to obtain 3 lb. tincture to which then add 1¼ dr. honey flavor oil.

340. Violet Type Fixative Base

Macerate 1 lb. Florentine orris root with 4 pints of alcohol of 15° overproof for six days, and then express off 3 lb. of liquid, to which add 2½ dr. ionone.

341. Composition of Genuine Floral Fondant Essence

Triple Extract...........	1½ oz.
Basic Essence...........	1½ "
Glycerin................	1½ "
Alcohol 15° overproof.....	11½ "
	1 lb.

342. Composition of Genuine Floral Ether

Triple Extract...........	1½ oz.
Basic Essence...........	1½ "
Universal Basic Ether....	13 "
	1 lb.

Artificial Floral Fondant Essences and Floral Ethers

In these the triple extracts are replaced by solutions of odorous substances, as given in the following table, the quantities

mentioned being dissolved in strong alcohol to make 1½ oz. of finished product, which is then used like the triple extracts as above:

343.	Cassie	10 dr.	Aubépine (Anisaldehyde)
344.	Heliotrope	6 "	Heliotropin
345.	Hyacinth	6 "	Hyacinthin
346.	Jasmine	6 "	Artificial Jasminol
347.	Lilac	12 "	Terpineol
348.	Lily of the Valley	12 "	Terpineol (Muguet)
349.	Orange Flower	1¼ "	Artificial Neroli Oil
350.	Rose	½ "	Artificial Rose Oil
351.	Violet	2½ "	Ionone, 20%

IX. SPICE EXTRACTS FOR BAKING

The essences used for flavoring cakes and other bakery products are usually made from volatile oils, because the natural essences, *i.e.*, those made from fruits, do not withstand the heat of the oven. Where fruit essences are ordered used, the fondant essences are to be employed. The essences of the tropical fruit rinds are to be used in the form of oil essences. For the nut-like extracts, such as hazel, pistachio, cocoa and walnut, the corresponding basic essences are employed, and the like is the case with the other essences, such as coffee, cacao, chocolate, etc.

(*a*) *Simple Spice Extracts*

These consist of solutions of volatile oils in slightly diluted alcohol, and have the following composition:

		Volatile Oil	Alcohol	Water
352.	Allspice	1½ oz.	13½ oz.	1 oz.
353.	Anise	¾ "	14½ "	¾ "
354.	Star Anise	¾ "	14½ "	¾ "
355.	Bergamot	¾ "	15¼ "	—
356.	Bitter Almond	1½ "	9½ "	5 "
357.	Calamus	1 "	14 "	1 "
358.	Cardamom	1 "	14 "	1 "
359.	Cinnamon	1 "	14 "	1 "
360.	Cloves	1 "	13½ "	1½ "
361.	Coriander	1 "	13½ "	1½ "
362.	Fennel	1 "	13½ "	1½ "
363.	Ginger	1 "	13½ "	1½ "
364.	Lemon	2 "	14 "	—
365.	Mace	1 "	14 "	1 "
366.	Nutmeg	1 "	14 "	1 "
367.	Orange Flower	⅛ "	14 "	1⅞ "
368.	Rose	½ dr.	14½ "	1½ "

(b) *Compositions*

The formulas for the fondant essences serve as the basis for most of the compositions, in so far as the basic essences are of vegetable character.

369. For arrac, cognac and rum essences, intended for bakery uses, only the pure genuine liquors fortified by the addition of 6 dr. vanillin per pound are employed.

370. Lemon Spice Extract

Cinnamon Oil	1¼	dr.
Vanillin	1¼	"
Clove Oil	2½	"
Lemon Oil	11	"
Alcohol	15	oz.
	1	lb.

371. Spice Oil for Baking

Fennel Oil	1¼	dr.
Mace Oil	2¼	"
Cardamom Oil	2½	"
Cinnamon Oil	6	"
Clove Oil	12	"
Benzaldchyde	3½	oz.
Lemon Oil	5	"
Alcohol	6	"
	1	lb.

372. Tonca Bean Extract

Vanillin	1¼	dr.
Cumarin	6¾	"
Tonca Bean Tincture	3½	oz.
Distilled Water	4	"
Alcohol	8	"
	1	lb.

373. Violet Extract for Baking

Ionone (20%)	2½	dr.
Triple Violet Extract	1½	oz.
Alcohol	14½	"
About	1	lb.

(c) *Bakery Spice Extracts*

374. Biscuit

Clove Oil	1¼	dr.
Vanillin	4¾	"
Benzaldehyde	10	"
Alcohol	13½	oz.
Rose Water	1½	"
	1	lb.

375. Butter Spice

Honey Flavor Oil	⅛	dr.
Benzaldehyde	1⅛	"
Sweet Orange Oil	2¾	"
Lemon Oil	4	"
Butyric Acid	1½	oz.
Alcohol	12½	"
Bitter Almond Water	1½	"
	1	lb.

376. Gingerbread

Apricot Flavor Oil	1½	dr.
Cardamom Oil	2½	"
Clove Oil	4	"
Ginger Oil	8	"
Lemon Oil	8	"
Alcohol	12½	oz.
Rose Water	2	"
	1	lb.

377. Glaze Flavor

Benzaldehyde	6 dr.
Lemon Oil	10 "
Rum Essence	2 oz.
Alcohol	12 "
Rose Water	1 lb.
	1 lb.

Note: Where a fruit taste or other aromatic flavor is desired, the appropriate essence is used instead of the alcohol in the formula.

378. Honeycomb

Honey Flavor Oil	1¼ dr.
Cardamom Oil	1¼ "
Cinnamon Oil	2 "
Clove Oil	2½ "
Orange Oil	5 "
Lemon Oil	½ oz.
Alcohol	12½ "
Bitter Almond Water	2¼ "
	1 lb.

379. Macaroons

Peach Flavor Oil	1½ dr.
Vanillin	3½ "
Orange Oil	5 "
Benzaldehyde	6 "
Alcohol	13 oz.
Brown Coffee Essence	2 "
	1 lb.

380. Melangebits

Peach Flavor Oil	1¼ dr.
Orange Oil	3¾ "
Benzaldehyde	5 "
Orange Flower Water	14 "
Strawberry Essence	2½ oz.
Alcohol	12 "
	1 lb.

381. Pastry

Celery Oil	2½ dr.
Ginger Oil	2½ "
Clove Oil	2¼ "
Butyric Acid (100%)	5 "
Lemon Oil	7½ "
Alcohol	13 oz.
Orange Flower Water	1¾ "
	1 lb.

382. Plum Pudding

Coriander Oil	1¼ dr.
Anise Oil	1¼ "
Vanillin	2½ "
Benzaldehyde	5 "
Lemon Oil	6 "
Alcohol	11 oz.
Rose Water	4 "
	1 lb.

383. Printen

Cardamom Oil	1 dr.
Coriander Oil	2 "
Ceylon Cinnamon Oil	2 "
Vanillin	5 "
Lemon Oil	10 "
Alcohol	13 oz.
Rose Water	1¾ "
	1 lb.

384. Speculatius

Cinnamon Oil	½ dr.
Clove Oil	1½ "
Benzaldehyde	5 "
Butyric Acid (100%)	6 "
Lemon Oil	7 "
Alcohol	13 oz.
Rose Water	1¾ "
	1 lb.

385. Tea Biscuits

Vanillin	6 dr.
Benzaldehyde	6 "
Lemon Oil	8 "
Alcohol	12 oz.
Orange Flower Water	2¾ "
	1 lb.

386. Wedding Cake

Vanillin	1¼ dr.
Benzaldehyde	4¾ "
Sweet Orange Oil	11 "
Alcohol	13 oz.
Rose Water	2 "
	1 lb.

X. CONFECTIONERY LACQUERS

The object in lacquering confectionery and chocolates is not only to improve the appearance of the goods, but also to guard them from the attacks of certain insects. Where the laws permit, alcohol, denaturized by the addition of 0.5% of turpentine oil and a little wood alcohol, may be used as a solvent.

387. Purified Benzoin

Crude Palambang or Sumatra benzoin, which always contains some imbedded pieces of bark, is comminuted, and dissolved in strong alcohol. Usually twice as much alcohol is used as the quantity of benzoin taken, and after frequent stirring for several days, an extract is obtained which rapidly clarifies itself. The residue may be again treated with strong alcohol. The extract is then distilled, the heat being raised until the thermometer in the still stands at 250° F. The alcohol distils over between 173° and 176°. The thermometer then rises rapidly to 212° C., and then slowly to 220° C. Then the heat is removed, and the resin allowed to run off into broad, shallow tins where it rapidly cools. The white, suffocating fumes evolved consist of benzoic acid. The purified benzoin must have a vitreous facture, and thin splinters must be transparent. It is employed for the rapid preparation of chocolate lacquers.

388. Purified Shellac

For this there is used the bleached, white shellac, which, however, still contains from 9 to 14% of water, due to its mode of manufacture. The mass is comminuted, and allowed to dry in an airy place with frequent turning-over and mixing, which requires from 3 to 4 weeks. Incompletely dried shellac dissolves only with difficulty, and incompletely, and prevents the clarification, deposition and filtration of the lacquers.

The following formulas are for lacquers obtained by cold solution of the resins in alcohol. The preparations are clarified by standing, and the liquids are then filtered through filtering paper, the filtration being facilitated by being conducted in a warm place.

389. Benzoin Lacquer for Chocolates

Benzoin, Crude	10 lb.
Alcohol	20 "

According to the quality of the benzoin, from 27 to 29 lb. of lacquer are obtained.

390. Lacquer for Chocolates

Brown Shellac	5 lb.
Sandarac	10 "
Alcohol	30 "

To the residual solution obtained, there are added further:

Alcohol-Soluble Brown Anilin Dye	3 oz.

391. Brilliant Lacquer for Confections

Mastic	½ lb.
Brown Shellac	1 "
Sandarac	2 "
Alcohol	7 "

392. Glaze Lacquer for Cream Confections

Pale Colophony	1 lb.
Sandarac	1 "
Alcohol	4½ "

393. Gingerbread Lacquer

Sandarac	1 lb.
Alcohol	2 "

394. Marchpane Lacquer

(From Sandarac, for cheap marchpane.)

Sandarac	1 lb.
Alcohol	2½ "

395. Marchpane Lacquer

(From shellac, for better products.)

Shellac, Bleached and Dried	1 lb.
Alcohol	2½ "

B. Fine Culinary Essences

The simple culinary spice essences are usually represented by solutions of volatile oils or extracts of vegetables of aromatic character. Besides these there are a number of compounds which are intended as additions to the warm spices, as well as for the pickling of pickles, and lastly the spice salts.

I. SIMPLE SPICE EXTRACTS

(a) Solutions of Volatile Oils

Extract for	Volatile oil.	Alcohol 38° over-proof.	Distilled water.	1 oz. extract corresponds to
	oz.	oz.	oz.	
396. Allspice	½	12	3½	5 oz. allspice
397. Basil	¾	13	2¼	10 " fresh herb
398. Bitter Almond	½	10	5½	3 lb. almonds
399. Caraway	1½	12	2½	5 oz. caraway
400. Celery	½	12	3½	5 heads celery
401. Ceylon Cinnamon	¾	14	1¼	5 oz. cinnamon
402. Cloves	½	13	2½	5 " cloves
403. Coriander	½	15	½	5 " coriander
404. Dill	¾	13	2¼	10 " fresh herb
405. Tarragon	¾	13	2¼	10 " " "
406. Fennel	1½	14½	....	5 " fennel
407. Laurel Leaves	½	13	2½	5 " laurel leaves
408. Marjoram	1½	13	1½	10 " marjoram, dry
409. Mugwort	¾	13	2¼	10 " fresh herb
410. Parsley	1	13	2	10 " " "
411. Savory	¾	13	2¼	10 " " "
412. Sage	½	12	3½	10 " " "
413. Thyme	½	12	3½	10 " " "

(b) *Fortified Extractives from Vegetables*

For the culinary spices the use of extractive flavors for rounding out the taste of certain aromatics cannot be avoided. In making such flavors 1 part of the aromatic drug is macerated with 4 parts of alcohol of 20° overproof, and after 6 days 3 parts by weight of extract are expressed off. To each pound of this extract there are then added the following quantities of volatile oils:

1 lb. extract.	Volatile oil to be added.	1 oz. corresponds to
	oz.	
414. Anise	¾	5 oz. anise
415. Calamus	¾	10 " calamus
416. Cardamom	1	5 " cardamom
417. Cinnamon Flower	½	5 " cinnamon flower
418. Ginger	½	10 " ginger
419. Juniper Berries	½	10 " juniper berries
420. Mace and Nutmeg	¾	5 " mace or nutmeg
421. Pepper, Black or White	¾	7½ oz. black, or 10 oz. white, pepper

(c) *Simple Vegetable Extracts*

The drugs are macerated in the proportions stated for 6 days with alcohol of the strength given, and then expressed.

	Extract proportion.	Alcohol strength.	Employment.
422. Asparagus (from dried peels)	1 : 3	proof	⅓ oz. per gallon bouillon
423. Capsicum or Chillies	1 : 5	38° overproof	1 oz. corresponds to 3 medium capsicum pods
424. Saffron	1 : 10	38° overproof	Coloring pastry
425. Vanilla (6 dr. vanillin added per lb. essence.)	1 : 10	proof	½ dr. per pint sauce; 1 dr. per lb. pastry

(d) *Extracts from Fresh Materials.* (*Capers, Chervil and Carrots*)

Capers and chervil are cut up small and expressed, while carrots are first scraped, and then expressed, in order to remove the juices. Each 2 lb. of the material so prepared are macerated with 4 lb. alcohol of 38° overproof for 3 days, and then expressed. The residue is then treated with 2 lb. of the expressed juice for one day, and again expressed, after which the two liquids are united. In the case of carrot extract, there are further added 6 dr. of carrot oil.

426.	Capers	$\frac{1}{2}$ to $\frac{3}{4}$ oz. per gallon sauce
427.	Carrots	1 dr. corresponds to a medium sized carrot
428.	Chervil	$\frac{1}{4}$ to $\frac{1}{2}$ oz. per gallon bouillon

(*e*) *Extracts of Fungi*

429. Champignons.
430. Morels.
431. Mushrooms.
432. Truffles.

1 oz. of each of these extracts represents about 10 oz. of the fresh fungus; about $\frac{3}{4}$ oz. is used per gallon of sauce or farce. The various fungi are used only in dried form, as only when dried do they develop their characteristic flavor. Great care must be taken, however, that they are dried at a moderate heat. The extracts are made as follows: One lb. of the dried fungus is macerated with 2 lb. alcohol of 20° overproof for 6 days, and the alcohol is then allowed to run off without expressing. To the residue 1 lb. of water is then added, the mixture allowed to stand for one day, and then fully expressed, and the liquids are united. No additions are necessary.

(*f*) *Onion Extracts*

These extracts are made from well-peeled onions which are to be finely cut up. In order that the extract should not be too mucous in character, the comminuted onions are first well expressed, the juice being discarded as valueless. To every pound of the residue then add 2 lb. strong alcohol, let stand for 3 days, and then express. Treat the residue once again, but with 2 lb. of proof spirit this time, then express after 3 days, and unite the liquids. To every pound of extract there is further to be added $\frac{1}{4}$ dr. true volatile oil of mustard.

Employment of Onion Extracts

433.	Chives and Garlic	1 oz. = 10 oz. fresh chives or $\frac{1}{4}$ dr. = 1 medium large garlic
434.	Onions	$\frac{1}{4}$ dr. = 1 medium onion
435.	Porrets	$\frac{1}{4}$ dr. = 1 medium porret
436.	Shallots	1 oz. = 10 oz. shallots

From $1\frac{1}{2}$ to 2 dr. of these onion extracts are to be used for $\frac{1}{4}$ gallon of bouillon or 1 lb. of meat. For boiling with fats, $1\frac{1}{4}$ to 2 dr. suffice for 5 lb. of fat.

II. CULINARY SPICE EXTRACT COMPOUNDS

(a) *Meat Spice Extracts*

437. For Beef, Veal and Fowl

Champignon Extract	1½ oz.
Celery Extract	2 "
Porret Extract	2½ "
Parsley Extract	2½ "
Carrot Extract	3½ "
Onion Extract	4 "
	1 lb.

438. For Mutton, Pork and Smoked Beef

Clove Extract	¾ oz.
Mace Extract	¾ "
Marjoram Extract	¾ "
Thyme Extract	¾ "
Basil Extract	¾ "
Savory Extract	1½ "
Celery Extract	3¾ "
Shallot Extract	7 "
	1 lb.

439. For Game, Wild Fowl and Meats to be Treated like Game

Truffle Extract	¾ oz.
Bay Laurel Extract	¾ "
Cardamom Extract	¾ "
Mace Extract	1½ "
Sage Extract	1½ "
Chives Extract	2½ "
Champignon Extract	2½ "
Juniper Extract	2½ "
Onion Extract	3¼ "
	1 lb.

440. For Boiled and Fried Fish

Ginger Extract	¾ oz.
Clove Extract	¾ "
Bay Laurel Extract	1½ "
Pimenta Extract	2½ "
Pepper Extract	2½ "
Onion Extract	8 "
	1 lb.

441. For Pickling, Shellfish, Etc.

Tarragon Extract	½ oz.
Sage Extract	¾ "
Cardamom Extract	¾ "
Dill Extract	1½ "
Bay Laurel Extract	2 "
Capsicum Extract	2½ "
Onion Extract	8 "
	1 lb.

442. Forced Meats

Mugwort Extract	¾ oz.
Cardamom Extract	¾ "
Porret Extract	1½ "
Savory Extract	1½ "
Caper Extract	1½ "
Truffle Extract	1½ "
Parsley Extract	1½ "
Champignon Extract	3 "
Onion Extract	4 "
	1 lb.

443. Goulash, Ragouts, Mock Turtle, Etc.

Juniper Berry Extract	¾ oz.
Parsley Extract	¾ "
Pepper Extract	1½ "
Morel Extract	2½ "
Asparagus Extract	3 "
Shallot Extract	3½ "
Onion Extract	4 "
	1 lb.

444. Patties

Bay Laurel Extract	½ oz.
Cardamom Extract	¾ "
Caper Extract	¾ "
Morel Extract	1½ "
Pepper Extract	1½ "
Truffle Extract	3 "
Onion Extract	3 "
Celery Extract	5 "
	1 lb.

445. For Brines, Aspic, Etc.

Caraway Extract.........	¾ oz.
Basil Extract............	1¼ "
Bay Laurel Extract......	1½ "
Pimenta Extract.........	2½ "
Pepper Extract..........	3 "
Onion Extract...........	7 "
	1 lb.

446. For Soups

Morel Extract...........	1½ oz.
Chervil Extract..........	1½ "
Celery Extract...........	3 "
Parsley Extract..........	3 "
Carrot Extract..........	7 "
	1 lb.

447. Sausage Spice Extract for Bologna, Sausage, Etc.

Bay Laurel Extract......	¾ oz.
Savory Extract..........	1¼ "
Pimenta Extract.........	2 "
Pepper Extract..........	5 "
Onion Extract...........	7 "
	1 lb.

448. Sausage Spice Extract for Hausmacher Sausage

Basil Extract............	¾ oz.
Thyme Extract..........	¾ "
Pepper Extract..........	2½ "
Marjoram Extract.......	6 oz.
Onion Extract...........	6 "
	1 lb.

449. Sausage Extract for Smoked Sausages (Salami, Mortadella, Etc.)

Cardamom Extract.......	¾ oz.
Savory Extract..........	1¼ "
Basil Extract............	2 "
Pepper Extract..........	4 "
Garlic Extract...........	8 "
	1 lb.

General Method of employing Meat Spice Extracts, etc.:

¼ to ½ dr. is to be used for every quart of meat bouillon, sauce or other liquid, and also for every pound of meat or meat mass.

450. Spice Extract for Mulled Beer, Punch, Mulled Wine, Etc.

Vanilla Extract..........	1½ oz.
Cardamom Extract.......	1½ "
Pimenta Extract.........	3 "
Clove Extract...........	3 "
Cinnamon Extract.......	6 "
	1 lb.

Of this, ⅛ dr. is to be used per pint of finished beverage.

(b) *Pickled-spice Extracts for Mustard, Spiced Vinegar, Pickles and Piquant Sauces*

451. Spiced-pickle Extract

Clove Extract...........	¾ oz.
Dill Extract.............	1¼ "
Celery Extract...........	1½ "
Pimenta Extract.........	2½ "
Acetic Acid (60%).......	3 "
Capsicum Extract........	3 "
Pepper Extract..........	4 "
	1 lb.

452. Curry-spice Extract

Turmeric Extract (made from turmeric roots like ginger extract).........	¼ lb.
Ginger Extract..........	¼ "
Pepper Extract..........	½ "
	1 lb.

453. Tarragon Extract

Acetic Acid (60%)	1½ oz.
Celery Extract	3 “
Tarragon Extract	11½ “
	1 lb.

454. "Fines Herbes" Spice Extract for Vinegar, Mustard, Vinegar Fruits, Salads and Fillers

Mugwort Extract	¾ oz.
Juniper Extract	¾ “
Thyme Extract	¾ “
Parsley Extract	¾ “
Acetic Acid (60%)	1½ “
Savory Extract	3 “
Caper Extract	3 “
Leek Extract	5½ “
	1 lb.

455. Mixed-pickles Spice Extract

Bay Laurel Extract	¾ oz.
Tarragon Extract	¾ “
Dill Extract	1½ “
Acetic Acid (60%)	1½ “
Pimenta Extract	2½ “
Capsicum Extract	2½ “
Caper Extract	3 “
Shallot Extract	3½ “
	1 lb.

456. Mustard-pickles Spice Extract

Volatile Mustard Oil	½ dr.
Alcohol	1½ oz.
Cardamom Extract	1½ “
Acetic Acid (60%)	1½ “
Capsicum Extract	1½ “
Celery Extract	1½ “
Onion Extract	1½ “
Pepper Extract	3 “
Dill Extract	4 “
	1 lb.

457. Piccalilli Spice Extract

Pepper Extract	1½ oz.
Celery Extract	1½ “
Pimenta Extract	1½ “
Volatile Mustard Oil	¼ dr.
Alcohol	1½ oz.
Leek Extract	2½ “
Pimenta Extract	3 “
Capsicum Extract	4½ “
	1 lb.

458. Salt-pickle Spice Extract

Acetic Acid (60%)	1½ oz.
Mugwort Extract	1½ “
Savory Extract	1½ “
Tarragon Extract	3½ “
Dill Extract	8 “
	1 lb.

Of these mixtures, ¼ to ½ dram is used per pint of vinegar used for pickling.

III. VINEGAR ESSENCE SPICES

Employment: 6 dr. per pound of vinegar essence (containing 60–80% vinegar), of which 8 parts are required to make 100 parts of domestic vinegar.

459. "Aux Fines Herbes"

Clove Oil	1½ dr.
Pimenta Oil	1½ “
Thyme Oil	3 “
Celery Oil	4 dr.
Tarragon Oil	6 “
Alcohol	7 oz.
Acetic Acid (80%)	8 “
	1 lb.

460. CELERY VINEGAR

Tarragon Oil	4 dr.
Celery Seed Oil	12 "
Alcohol	7 oz.
Acetic Acid (80%)	8 "
	1 lb.

461. TARRAGON VINEGAR

Cognac Oil	1 dr.
Tarragon Oil	11 "
Alcohol	7¼ oz.
Acetic Acid (80%)	8 "
	1 lb.

462. FRUIT VINEGAR

Cognac Oil	1 dr.
Ethyl Acetate	5 "
Strawberry Essence	10 "
Raspberry Essence	4 oz.
Alcohol	4 "
Acetic Acid (80%)	7 "
	1 lb.

463. MALT VINEGAR

Cognac Oil	1 dr.
Ethyl Acetate	7 "
Malt Essence	7 oz.
Acetic Acid (80%)	8 "
	1 lb.

464. MUSTARD VINEGAR

Volatile Mustard Oil	1 dr.
Pimenta Oil	3 "
Sassafras Oil	4 "
Tarragon Oil	8 "
Alcohol	7 oz.
Acetic Acid (80%)	8 "
	1 lb.

465. WINE VINEGAR

Cognac Oil	2½ dr.
Celery Oil	5½ "
Acetic Ether	8 "
Alcohol	7 oz.
Acetic Acid (80%)	8 "
	1 lb.

IV. SPICE SALTS

The spice salts are made by rubbing the extracts, made as follows, and the volatile oils with a little fine table salt until thoroughly mixed, then adding the balance of the salt, mixing thoroughly, and sifting.

(a) *Simple Spice Salts*

466. CELERY SALT

Celery Seed Oil	4 dr.
Alcohol	4 "
Table Salt	15½ oz.
	1 lb.

467. PEPPER SPICE SALT

Capsicum Extract	6 dr.
Pepper Extract	10 "
Table Salt	15 oz.
	1 lb.

(b) *Compound Meat Spice Salts*

These are employed by painting on the meat which is to be prepared, and which is then treated as usual.

468. Bouillon Spice Salt for Potted Meats, Etc.

Basil Oil	¾ dr.
Celery Oil	1 "
Parsley Oil	1¼ "
Carrot Seed Oil	1½ "
Pepper Extract	2 "
Leek Extract	5½ "
Table Salt	15¼ oz.
	1 lb.

469. Roast Spice Salt for Roasts, Broils, Etc.

Carrot Seed Oil	½ dr.
Parsley Seed Oil	1 "
Celery Seed Oil	2½ "
Pepper Extract	4 "
Onion Extract	8 "
Table Salt	15 oz.
	1 lb.

470. Game Spice Salt for Game and Wild Fowl

Sage Oil	⅛ dr.
Cardamom Oil	⅛ "
Mace Oil	⅛ "
Juniper Oil	⅜ "
Pimenta Oil	½ "
Pepper Oil	2¾ "
Champignon Extract	4 "
Shallot Extract	8 "
Table Salt	15 oz.
	1 lb.

471. Fish Spice Salt

Bay Laurel Oil	⅛ dr.
Clove Oil	¼ "
Ginger Oil	¼ "
Celery Oil	2⅜ "
Pimenta Oil	3 "
Pepper Extract	3 "
Onion Extract	7 "
Table Salt	15 oz.
	1 lb.

(c) *Sausage Spice Salts*

The following are mixtures of spice extracts and volatile oils, to make quantities of 1 oz. By means of these, simple spice salts can be made for the treatment of unsalted meats, 1 oz. of the particular spice salt being mixed with 15 oz. of table salt. For making a *double strength* sausage spice salt, calculated on *salted* meat, 1 oz. of the spice substance is to be mixed with 7 oz. of table salt. For unsalted meat 10 oz. to 1 lb. of the spice salt per 100 lb. are used, while for salted meat 5 to 8 oz. per 100 lb. are required.

472. Sausage Spice Salt

Bay Laurel Oil	1/32 dr.
Savory Oil	1¼ "
Pimenta Oil	1½ "
Onion Extract	5¼ "
Pepper Extract	8 "
	1 oz.

473. For Country Sausage

Marjoram Oil	¾ dr.
Pimenta Oil	1 "
Pepper Oil	2¼ "
Capsicum Extract	6 dr.
Onion Extract	6 "
	1 oz.

474. For Smoked Sausage

Pimenta Oil	1 dr.
Cardamom Oil	1 "
Parsley Oil	2 "
Pepper Oil	2 "
Pepper Extract	10 "
	1 oz.

475. For Liver Sausage

Savory Oil	½ dr.
Marjoram Oil	2½ "
Pepper Oil	3 "
Truffle Extract	5 "
Onion Extract	5 "
	1 oz.

476. Tongue Sausage Spice

Cardamom Oil	½ dr.
Marjoram Oil	1 "
Pepper Oil	2 dr.
Champignon Extract	5½ "
Onion Extract	7 "
	1 oz.

477. Onion Sausage Spice

Pepper Oil	1 dr.
Thyme Oil	1½ "
Marjoram Oil	2½ "
Shallot Extract	11 "
	1 oz.

(d) *Pickle Spice Salts*

478. Spiced-pickle Spice Salt

Volatile Oil Mustard	¼ dr.
Celery Oil	½ "
Dill Oil	½ "
Pimenta Oil	2¾ "
Pepper Oil	4 "
Capsicum Extract	8 "
Table Salt	15 oz.
	1 lb.

479. Salt-pickle Spice Salt

Tarragon Oil	1½ dr.
Dill Seed Oil	2½ "
Pepper Extract	8 "
Table Salt	15¼ oz.
	1 lb.

Of these salt mixtures 6 dr. are required per pint of pickling liquid.

PART VII

COLORING MATTERS

1. Physiological Determination of Colors.
2. Vegetable Colors.
3. Preparation of Vegetable Fat-soluble Dyes (Alkannin; Chlorophyll; Bixin)
4. Application of Vegetable Dyes.
5. Aniline, or Tar, Dyes (Dye Solutions; Inspissated and Paste Dyes).
6. Bleaching and Decolorizing.

PART VII

COLORING MATTERS

1. Physiological Determination of Colors

According to modern scientific investigations, great importance must be ascribed to the influence of the senses of sight, smell and taste, as well as the psychological effects of these, on the digestion. The judgment in regard to the proper coloring is, in particular, of great importance because of the effect on digestion, and hence also on nutrition. Every nutrient or comestible usually has a color of its own which, according to its character, has a corresponding stimulant effect on the appetite. Where nature fails to impart such a color, this must be imparted to the preparation either by appropriate methods of manufacture or by means of suitable coloring matters. This coloring in effect increases the nutritional value of a nutrient, because of an apparently heightened stimulus to digestion. Of course it is not the purpose of any coloring to create illusions regarding the effective values of nutrients, such as imparting a color to those that have become spoiled and have lost their color, or by adding colors to make preparations resemble those which naturally are colored. For this reason it is generally forbidden to color preparations to imitate the characteristic colors of natural products such as wines, fruit juices, etc. This applies also to products from which these are chiefly made, while on the other hand the coloring, or the replacement of colors which have been lost, is regarded as permissible when declared, because in this case there is no intention to deceive, but only to heighten the appetizing quality.

Nature itself decks its products, particularly those of the Vegetable Kingdom, with appetizing colors, as in fruits, vegetables, etc. In early times the colors used were obtained exclusively from natural products, certain drugs, in fact, yielding very valuable dyes which found application chiefly in dyeing. As the coal-tar dye industry developed to undreamt proportions during the last century, the coal-tar dyes produced displaced the natural

vegetable dyes. The aniline dyes present the most varied and brilliant shades of colors, are of extreme intensity, and are very simple to use; they constitute the best possible coloring, particularly for food products, because the vegetable colors are very unstable, and are easily changed by the action of acids, heat, etc., when products colored with them are long kept. However, the aniline dyes labor under a certain disadvantage, because they may contain arsenic derived from the raw materials from which they are made, hence they may be toxic. At the present time all communities regulate by law the employment of dyes, and demand that these be absolutely harmless, and hence in most countries the use of aniline dyes is allowed. Some countries, however, permit the use of only vegetable dyes in such cases where food products are allowed to be colored at all.

2. Vegetable Dyes

Blue: The only blue vegetable dye is indigo, which results from the oxidation of a colorless glucoside present in the indigo plant and various other species. Indigocarmine, a water-soluble form of indigo, is the sodium salt of indigosulphonic acid. Blue dyes are scarcely required for coloring nutrients and foods, but are serviceable as a basis for green dyes, *i.e.*, mixed colors made from blue and yellow.

Brown: The most usual coloring is sugar coloring, or caramel (burnt sugar), which serves for aqueous liquids, and which, when specially prepared, is used as the so-called "rum coloring" for alcoholic liquids. For this purpose a concentrated solution of caramel is mixed with strong alcohol, and when precipitation is complete, the mixture is filtered and the filtrate concentrated by evaporation to form an extract. Another brown coloring is catechu, a plant extract containing tannin, and which is particularly used for coloring rum.

Yellow: Of all the vegetable dyes this is the most troublesome. Most of the raw materials possess the property of not being fast to acids, but developing their brilliant color only in the presence of alkalies. The most important of these are the yellow berries, or French berries, obtained from a buckthorn species (*Rhamnus infectoria*) of which the unripe berries yield an intense yellow dye which, however, cannot be used in acid liquids. Safflower, the florets of

Carthamus tinctorius, affords both a yellow and a reddish-yellow dye. The carthamic acid, obtained from the florets, dyes to the extent of 3 to 5%, and constitutes the only serviceable acid-fast vegetable yellow coloring, which may also be used for lemonades. For alcoholic liquids, tinctures of curcuma root or of saffron are used, but both have penetrating and characteristic tastes. Orlean, more commonly known as annatto, or arnotta, and used partly in the form of the fruit paste, partly in the form of seeds, obtained from a Bixa species (*Bixa Orellana*), contains a very intensive yellow vegetable dye which is particularly adapted for coloring oils, butter and cheese.

Green: With the exception of chlorophyll, which is rather difficult to manage, green is usually a mixture of yellow and blue dyes using indigo as a base for the blue, and curcuma, saffron, or, safflower as the yellow.

Red: The number of red dyes is comparatively large, because most fruit juices contain such a dye. Unfortunately, however, the major portion of the dye is contained in the skins, as for instance in the huckleberry, red grapes, etc., and only a small portion is found dissolved in the fruit juice. Dark fruit juices are used to impart a color to light-colored juices, but this, when done, must be declared on the label. Most rationally vegetable colorings are made from berries, as huckleberries, by exhausting the berries, deprived of their juice, with alcohol, and then evaporating the tincture to form an extract. In a similar manner the red coloring matter, œnocyanin, present in the red grape, is obtained, and it serves more particularly for coloring vinegar, etc. The red dyes of fruits and fruit juices are exceedingly sensitive unless they are used in acid liquids. In alkaline liquids, for instance, they change to a dirty-green color. Other red dyes are found in various dye woods, such as santal wood, Pernambuco wood and also archil, a lichen yielding also cudbear. For coloring foods the mallow coloring matter found in the deep black flowers of *Malva arborea* is also largely used. The flowers also contain a considerable quantity of pectin, and particularly also tannin, at the points where they are attached to the calyx. The dried flowers are freed from these constituents and then treated with strong alcohol rendered decidedly acid with tartaric acid; on evaporating off the solvent there is obtained an extract which is employed to color acid food products, such as vinegar, etc. One of the most

important of the red dyes is the insect, cochineal, the coloring matter of which, carminic acid, constitutes the expensive but very brilliant coloring which is frequently used in food products. Cochineal is only partially acid-fast, and develops a particularly fine color in ammoniacal solution, nevertheless it is largely used for coloring confectionery and bakery products.

Violet: Under this is understood mixed colors of indigo and cochineal.

3. Manufacture of Fat-soluble Vegetable Dyes

The manufacture of alkannin, chlorophyll and annatto dyes is very general, and is profitable on the large manufacturing scale because the products are very widely used for coloring foods and edibles of all kinds, hence a description of the methods of manufacture is in place here, the more so as these dyes are also concerned in the manufacture of essences. In all three cases we are concerned with the exhaustion of a vegetable extract which is present in these dyes as an extractive matter.

Alkannin: This is a fine red dye, present in large quantity in the foliaceous layer of bark of the oriental alkanet root (*Anchusa tinctoria*). The dried root is exhausted in an iron extraction apparatus with benzin. The dye is very sensitive to copper, and hence can be made only in iron vessels. The yield of fat-soluble dye is 5 to 6%. An alcoholic extract can also be made by exhausting the root with alcohol, but it is not soluble in diluted alcohol, or water. With alkalies the dye gives a fine blue color. Alkannin is used only for coloring fats, etc.

Chlorophyll: This preparation is very largely used for coloring oils and soaps, and is to some extent used also for preserves. There is really no substitute for chlorophyll as a fat dye, and no aniline dye has been able to displace it. Besides this, its colorific power is exceedingly great, it being used in some cases to color fats and soaps a green color, as well as to neutralize any predominant yellow color and impart, by complementary coloring, a neutral and whiter color to products. Chlorophyll is contained in all green plant parts, from which it is obtained by extraction with strong alcohol, in the form of an extract, to the extent of about 5%. This is commonly but erroneously designated commercially as being 100%, since dilutions of this extract with fatty substances

are also common. Nevertheless there may be made preparations of higher concentration from the original extract by removing the accompanying substances, such as plant fats and resins. The chlorophyll is really a mixed color, consisting of two coloring matters, the pure yellow xanthophyll and the bluish-green phyllocyanin. The former can be removed by treating the alcoholic solution of the extract with benzin, into which the bluish-green coloring matter passes while the alcohol retains chiefly the yellow dye. The latter is known under the name "lutein," as a fat dye. Phyllocyanin is itself bluish-green in color, but it has the property of combining with metal salts, and particularly with copper, to afford magnificent green compounds. For this reason the extraction is primarily carried out in the presence of copper salts, such as copper chloride, so that the colorific constituent of the various commercial chlorophylls is a copper compound of phyllocyanic acid. On this same principle is based also the greening of vegetables, for instance, in the preserving industry, by the addition of minute quantities of copper salts, or the greening of pickles in copper kettles, wherein the natural chlorophyll of the vegetables enters into combination to form a copper compound which is not only very stable, but which is not decomposed even by the gastric juice, and which may hence be regarded as harmless.

Chlorophyll is hence first and foremost a fat-soluble dye. The chlorophyll dye may be converted into an alkali compound, however, whereby it is rendered soluble in water. This water-soluble chlorophyll is used for coloring preserves, and in the following manner: The vegetables are boiled in a dye solution until soft, whereby the plant tissues become charged with the coloring, and then the colored liquid is allowed to drain off, the material being next treated with very dilute vinegar. By this treatment the alkali compound of the chlorophyll is again converted into an insoluble compound which adheres pigment-like to the fibers, while the traces of vinegar are washed out. The vegetables are then colored permanently green, and impart no green color to the liquor in which they are marketed.

The *annatto dyes* are made exclusively from annatto seed by extraction with ether. The extract, bixin, is soluble in fats and oils with pure yellow color, and is used particularly for butter and cheese; for the latter purpose it is dissolved in ammonia whereby its color is changed to a reddish or egg-yellow tint.

4. Application of Vegetable Dyes

These are mostly used in the form of tinctures for coloring foods, the tinctures being made with alcohol. For those intended for use in acid media, some acid must be added during the process of extraction. All vegetable dyes are exceedingly sensitive to metals, which change the character of the color because they enter into combination with the dye, and such compounds usually possess a different color. Chlorophyll alone assumes on contact with copper a brilliant green color, whereas with iron it acquires a brown color. Fruit juices are always discolored by iron, partly because this reacts with the tannin present in most plants, and partly because it acts on the coloring matter itself. Hence it is a basic rule in pressing fruit juices that iron must form no part of the press.

The method of making the so-called "paste dyes," which have found special application in the confectionery industry, is rather difficult to apply to vegetable colors, because here the interaction of acids and alkalies comes into question, in order to obtain precipitates. The most suitable for the purpose, however, are the precipitates obtained with stannic acid, by treating a hot solution of stannous chloride with a slightly alkaline solution of the coloring matter. According to the concentration of the dye solution and the degree of heat employed, there may be obtained, particularly with buckthorn berries, magnificent yellow to deep-red precipitates which are fully resistant to acids. By complementary coloring with indigo a green color is obtained, while with cochineal a red color is obtained. The vegetable-stannic acid dyes are marketed under the name "Breton Dyes," and are used for coloring confectionery where tar dyes are not permitted.

5. Aniline, or Tar, Dyes

The use of these is permissible only as the laws allow. These dyes are forbidden as a matter of principle for coloring fruit juices, wines and similar preparations, but they are allowed for other fruit products, such as jellies and marmalades, but naturally only when declared on the labels. In most cases the aniline dyes require no declaration of their presence in liqueurs or effervescent lemonades, nor in confectionery. Most of the aniline dyes usually used are mixed colors made from comparatively few

basic dyes; they may also be dilutions of very concentrated basic colors, the mixtures being made with the aid of milk sugar, ordinary sugar, starch, dextrin, table salt or anhydrous sodium sulphate. The salt mixtures are the least harmful, while starch and dextrin partially impair their solubility. Some of the tar dyes have naturally an unpleasant odor, while others again decompose in the presence of certain substances, particularly acids, which decompose the alkali compounds of these dyes, whereby the very bitter picric acid which serves as a constituent is liberated. Hence it happens that the yellow colors in particular often have a decided bitter taste in acid solutions, and care must therefore be exercised in regard to this. The tar dyes are usually used in the form of a solution of 1 part in 20 parts of boiling water. After cooling, the liquid is filtered. In order to render the solution stable it may be preserved, best with the aid of alcohol. A stronger solution is not advisable because the full coloring power of the dyes is not then completely utilized.

The so-called inspissated dyes used particularly in the confectionery industry constitute another form of application. These are usually prepared by dissolving 5 parts of the dye in 10 parts of hot water, then adding 15 parts of glucose or starch sugar, and boiling down to 20 parts. The dye is then obtained in the form of a viscid liquid.

For confectionery there is very often employed the alumina dyes, in the form of the so-called paste dyes. For making these the greater number of the aniline dyes are adapted, where these are alkali-fast. Only the dyes of the eosine group cannot be used. With the other dyes experience alone shows which of them affords the most brilliant colors. Besides, it makes a decided difference whether the precipitation of the several colors is effected in the cold or when hot. The principle governing the manufacture of the paste dyes is based upon the precipitation of aluminum sulphate by sodium carbonate, when carbon dioxide is evolved, and aluminum hydroxide precipitated as a white powder. When, however, the precipitation is effected in the presence of a dye, which, according to its character is dissolved either in the sodium carbonate solution or in that of the aluminum sulphate, the aluminum hydroxide as it precipitates carries down with it mechanically the dye. The paste dyes contain practically about 30% of aluminum hydroxide, which with the balance of 70%

water forms a pasty mass. The method of manufacture is to dissolve 165 parts by weight of sodium carbonate in five times the quantity of water, and to add a cold solution of 130 parts by weight of aluminum sulphate in three times its quantity of water, after having dissolved the selected dye in either one of the two solutions. The reaction to a certain extent yields a neutral liquid, sodium sulphate being formed at the same time. The liquid is decanted from the precipitate, and the latter is then washed by stirring frequently with fresh water and decanting, until the liquid draining off is no longer colored and contains no sodium sulphate in solution, which may be ascertained by testing for sulphuric acid, using barium chloride. The mass is then allowed to drain, when there is obtained as a result about 100 parts by weight of paste dye. For this quantity about 5 parts by weight of dye are required, so that the paste dye contains about 5% dye.

Oil-soluble dyes are chiefly used for coloring wax, fats, oils, etc. They are made fat-soluble by a special method, and must be dissolved only with the aid of a very gentle heat, because they already decompose at the melting-points of the consistent fats. Wherever possible, alkannin, chlorophyll or annatto should be used, as these stand higher temperatures. Where it is a question of testing the fat-soluble vegetable dyes for the presence of admixed tar dyes, turpentine oil is used as a solvent, as this immediately decomposes the tar dye.

For coloring lacquers, such as, for instance, marchpane lacquer, or zapon lacquer for incandescent bulbs, the alcohol-soluble tar dyes are employed.

6. Bleaching and Decolorizing

The decolorization of liquids is usually effected by means of charcoal, which possesses the power to absorb dyes from their solutions. Unfortunately, however, with aromatic liquids this action is exerted at the same time at the expense of the flavor, as the flavoring is to some extent also removed. In the removal of an adventitious color, as, for instance, the yellow color developed in alcohols on storage, it is usually sufficient to filter the liquid through charcoal. Intensive yellow and brown plant dyes, as well as caramel, cannot be so easily removed by charcoal. Another means of removing such intensive dyes, however, consists in the

precipitation with milk. The coagulating albumin or casein mechanically carries down with it the dye.

Bleaching, as such, comes into question only in the case of casks which had previously contained a colored liquid, but which it is desired to use for lighter-colored liquids. For this purpose, the method of bleaching consists in rinsing the casks with a 0.5% solution of potassium permanganate, whereby the wood is first stained dark brown; the casks are then rinsed with diluted hydrochloric acid, whereby the permanganate is reduced, and a thorough bleaching effected. A similar process consists in rinsing the casks with a concentrated solution of potassium dichromate followed by treatment with diluted sulphuric acid, whereby reduction is also effected.

PART VIII

COSMETIC ESSENCES

A. Perfumery

I. MANUFACTURE OF FLOWER EXTRACTS

Enfleurage, and Flower Pomades.
Infusion and Extraction.
Extract Manufacture.

1. Trade forms of Triple Extracts

II. BASIC PERFUMERY ESSENCES

(a) *Tinctures*

2. Ambergris.
3. Cantharides.
4. Castor.
5. Orris.
6. Musk.
7. Calisaya.

(b) *Resinous Extracts*

8. Benzoin.
9. Peru Balsam.
10. Tolu Balsam.
11. Liquid Styrax.

(c) *Solutions*

12. Cumarin.
13. Heliotropin.
14. Artificial Musk.
15. Vanillin.

III. EXTRACT COMPOSITIONS (HANDKERCHIEF PERFUMES)

16. Ambre Royal.
17. Floral Bouquet.
18. Buckingham Flowers.
19. Chypre.
20. Russian Leather.
21. Cyclamen.
22. Ess Bouquet.
23. Ess Bouquet, London Style.
24. Frangipanni.
25. Gaultheria.
26. Geisha.
27. Gilliflower (Giroflée).
28. Glycinea.
29. Guard Bouquet.
30. Heliotrope.
31. Honeysuckle.
32. Hovenia.
33. Huntsman's Nosegay.
34. Hyacinth.
35. Jasmine.
36. Indian Bouquet
37. Jockey Club.
38. Jonquille.
39. Ki-Loe du Japan.
40. Kiss-Me-Quick.
41. Lilac, I.
42. " II.
43. " Turc.
44. Lily.
45. Linden Flowers.

46. Magnolia.
47. Lily of the Valley, I.
48. " " " II.
49. " " " III.
50. Millefleurs.
51. Mimosa.
52. Mousseline.
53. Musk.
54. Myrte.
55. Narcisse.
56. Navy's Nosegay.
57. New-mown Hay.
58. Orange Flower, I.
59. " " II.
60. Opoponax.
61. Orchidée.
62. Patchouly.
63. Peau d'Espagne.
64. Peony.
65. Pinks.
66. Queen of the Night.
67. Queen Victoria Bouquet.
68. Reseda.
69. Rondeletia.
70. Rose.
71. " Eglantine.
72. " Maréchal Niel.
73. " Moss.
74. " White.
75. Royal Horse Guard Bouquet.
76. Royal Nosegay.
77. Spring Flower.
78. Spring Nosegay.
79. Stephanotis.
80. Sweet Pea.
81. Trèfle.
82. Tulip.
83. Verbena, I.
84. " II.
85. Vine Flower.
86. Violet Parme.
87. " Riviera.
88. " Wood.
89. " Artificial.
90. Volkmeria.
91. West End Bouquet.
92. Yacht Club.
93. Ylang-Ylang.

IV. AROMATIC WATERS

Eau de Cologne

94. Court Water.
95. Eau de Cologne, I.
96. " " " II.
97. Lilac.
98. Lily of the Valley.
99. Rose.
100. Violet.
101. Hungarian Water.

V. TOILET WATERS

102. Cananga Water.
103. Florida "
104. Lavender "
105. " " Double.
106. Lavender Ambrée.
107. Lisboa Water.
108. Portugal Water.
109. Toilet " Lilac.
110. " " Lily of the Valley.
111. " " Rose.
112. " " Violet.
113. Verbena.

VI. TOILET VINEGARS

114. Toilet Vinegar.
115. " " Four-Thieves.
116. Toilet Vinegar Rose.
117. " " Violet.

VII. DRY PERFUMES

(*a*) *Tablet Perfumes*

118. Base Mass for Violet.
119. " " " Other Odors.
120. Heliotrope.
121. Lilac.
122. Lily of the Valley.
123. Violet.

(b) *Sachets*

124. Sachet Base.
125. Heliotrope.
126. Lilac.
127. Rose.
128. Violet.

(c) *Peau d'Espagne*

129. Essence for Peau d'Espagne.

(d) *Smelling Salts*

130. Lavender Salt.
131. Smelling Salts.

VIII. FUMIGANTS

(a) *For Fumigation*

132. Fumigating Essence.
133. " Vinegar.
134. " Paper.

(b) *Room Sprays*

135. Eucalyptus.
136. Pine Needle.

B. Cosmetic Essences

I. CARE OF THE MOUTH

(a) *Mouthwashes*

137. Anatherin.
138. Quinosol.
139. Eau de Botot.
140. Eucalyptus.
141. Salol.
142. Thymol.

(b) *Cachous*

143. Pastilles (cachous).

II. CARE OF THE TEETH

(a) *Tooth Pastes*

144. Base.
145. Eucalyptus.
146. Peppermint.

(b) *Tooth Powders*

147. Base.
148. Eucalyptus.
149. Peppermint.

(c) *Toothsoap Cream*

150. Perfume for Tooth Soaps.

III. CARE OF THE NAILS

151. Perfume for Nail Powder.

IV. CARE OF THE SKIN

(a) *Skin Creams*

152. Glycerin Cream.
153. Lanolin "
154. Toilet "
155. Vaselin "

(b) *Powders*

156. Fat Powder.
157. Rice Powder.

V. CARE OF THE HAIR

(a) *Hair Oils*

158. Hair Oil Perfume, I.
159. " " " II.
160. Arnica Hair Oil.
161. Burdock Hair Oil.
162. Flower " "
163. Macassar Oil.

223. Hyacinth.
224. Lavender.
225. Lilac.
226. Lily Milk.
227. Linden Flowers.
228. Lily of the Valley.
229. Milk.
230. Millefleurs.
231. Musk.
232. New Mown Hay.
233. Patchouly.
234. Peach Flowers.
235. Pinks.
236. Reseda.
237. Rose.
238. " White.
239. Strawberry.
240. Vanilla.
241. Violet.
242. Ylang-Ylang.

IV. MILLED SOAPS

243. Almond Flowers.
244. Bitter Almonds.
245. Cananga.
246. Chypre.
247. Eau de Cologne.
248. Ess Bouquet.
249. Florida Water.
250. Frangipanni.
251. Heliotrope.
252. Honey.
253. Indian Flowers.
254. Jockey Club.
255. Lavender.
256. Lettuce.
257. Lilac.
258. Lily Milk.
259. Lily of the Valley.
260. Millefleur.
261. Musk.
262. New Mown Hay.
263. Peau d'Espagne.
264. Pinks.
265. Rose.
266. Rose, Tea.
267. " White.
268. Sweet Pea.
269. Trèfle.
270. Violet.
271. " Nizza.
272. Ylang-Ylang.

V. TRANSPARENT SOAPS

273–275. Glycerin Soaps.
276. Heliotrope.
277. Lily of the Valley.
278. New Mown Hay.
279. Reseda.
280. Rose.
281. Violet.

VI. LIQUID SOAPS

282. Glycerin Soap.
283. Toilet Soap.

VII. SHAVING SOAPS

284. Shaving Soap.
285. " Cream, Rose.
286. " " Violet.

VIII. SKIN CREAMS

287. Lanolin.
288. Lanolin Cold Cream.
289. Vaselin.

IX. MEDICATED SOAPS

290. Borax Soap.
291. Pine Needle Soap.
292. Pumice Soap.
293. Salicylated Soap.
294. Tannin Soap.

PART VIII

COSMETIC ESSENCES

A. Perfumery

I. MANUFACTURE OF FLOWER EXTRACTS

The floral odors are obtained in their original form from the fresh flowers, but as they are usually very volatile in character, some fixative substances are added to them to render them more permanent. In making these odors one is of course restricted to the seasons when the flowers are in bloom. The delicacy of the perfumes forbid the use of distillation methods, and they can be obtained only by extraction methods. The manufacture is one restricted exclusively to a large scale, and can here be described only briefly.

Enfleurage, and Flower Pomades

The fresh flowers are worked by the enfleurage method in such a way as to transfer their perfume to a very fine, odorless lard. For this purpose the fat is spread in very thin layers on frames which may be piled on one another, and which permits inserting alternately between them wire frames charged with the fresh flowers, whereby the thin fat layer becomes charged with the floral perfume. The layers of flowers are renewed repeatedly, and until the fat is thoroughly charged with the perfume. When this is effected, there is obtained the so-called true flower pomade. This method yields decidedly finer results than those afforded by the older method in which the flowers were directly exhausted with the just-liquefied fat, the latter then expressed off, and repeatedly used with fresh batches of flowers till fully charged. Flower pomades so made are usually colored by the flowers.

In certain cases, particularly for floral hair oils, pure oil is also used, the fresh batches of flowers being treated with warm oil, as already described. Such preparations form the basis of the

better kinds of hair oils, whereas the pomades serve for the manufacture of perfume extracts, by transferring their perfumes to alcohol.

Infusion and Extraction

In this the fresh flowers are usually exhausted with pure petroleum ether, although carbon disulphide is also used, the process being carried out in the cold. After extraction, the solvent is evaporated off, when there remains a true flower extract of oily consistency, containing the floral perfume in all its purity. This preparation (Essence concentrée), too, is washed with alcohol to obtain extracts.

Extract Manufacture

I. TRADE FORMS OF TRIPLE EXTRACTS

For making these, the flower pomades described above are washed with strong alcohol. This is done by thoroughly stirring the fat with an equal weight of alcohol, using a mechanically-driven stirrer. By this treatment the alcohol washes out the perfume and dissolves it. The alcoholic solution is then drawn off, and subjected to a chilling process in order to separate from it the fat, a certain quantity of which it also dissolves out. The residual pomade is once again treated in similar manner with alcohol, whereby a second, but less-powerfully odorous, extract is obtained, and which is utilized either as a second-quality extract, or as a solvent for fresh portions of pomade; the pomade remaining after the treatment with alcohol, and which still always has a decided odor, is used as a base for fine soaps. We have thus at hand the means for preparing extracts of any desired concentration. For the trade, these extracts are usually diluted according to the price they are to bring. In the following formulas the so-called *triple extracts* will, as a rule, be discussed, these representing the products obtained by the first washing of the pomades.

II. BASIC PERFUMERY ESSENCES

It is assumed in advance, that in all manipulations requiring the use of alcohol, only the finest alcohol exclusively, of high strength, must be used, in order that the products may always be mixed without any turbidity.

(a) *Tinctures*

The aromatic drugs employed are exhausted with alcohol, each in the special degree of concentration mentioned.

2.	Ambergris Tincture	4 dr.	per lb.	
3.	Cantharides Tincture	1½ oz.	"	(only for hair washes).
4.	Castor Tincture	½ dr.	"	
5.	Orris Root Tincture	5 oz.	"	
6.	Musk Tincture	10 dr.	"	
7.	Calisaya Tincture	3 oz.	"	

Wherever any other tincture is ordered, it is to be made in the strength of 3 oz. per pound.

(b) *Resinous Extracts*

8.	Benzoin	5 oz.	per lb.
9.	Peru Balsam	3½ oz.	"
10.	Tolu Balsam	5 oz.	"
11.	Liquid Styrax	4 oz.	"

(c) *Solutions*

Under this we understand solutions of artificial odorous substances in strong alcohol, all solutions containing 7 dr. per pound.

12. Cumarin.
13. Heliotropin.
14. Artificial Musk.
15. Vanillin.

Note. — Where musk is ordered in these formulas, this is always to be understood as the artificial musk; and for *civet*, the artificial *zibethin* is likewise to be used in the given case, in 1 per cent solution.

III. EXTRACT COMPOSITIONS (HANDKERCHIEF PERFUMES)

In the following formulas the triple extracts to be employed are simply designated by the names of the flowers which they represent.

16. Ambre Royal

Musk	⅜	dr.
Patchouly Oil	⅜	"
Resedageraniol	¾	"
Vanillin	1¼	"
Ambergris	1½	"
Benzyl Acetate	6½	"
Styrax Solution	9¼	"
Benzoin Solution	12	"
Ambergris Tincture	2	oz.
Vanillin Solution	2	"
Musk Solution	2	"
Jasmine	4	oz.
Rose	4	"
	1	lb.

17. Floral Bouquet

Orange Oil	3½	dr.
Lemon Oil	3½	"
Bergamot Oil	4	"
Benzoin Solution	5	"
Rose	4	oz.
Tuberose	5	"
Violet	5	"
	1	lb.

18. Buckingham Flowers

Lavender Oil	⅛	dr.
Neroli Oil	⅛	"
Rose Oil	¼	"
Orris Root Tincture	11½	"
Ambergris Tincture	12	"
Orange Flower	3¼	oz.
Jasmine	3¼	"
Cassie	3¼	"
Rose	4¾	"
	1	lb.

19. Chypre

Calamus Oil	¼	dr.
Patchouly Oil	¼	"
Sandal Oil	¼	"
Cumarin	½	"
Vanillin	½	"
Bergamot Oil	1	"
Zibethin (10% solution)	1¼	"
Castor Tincture	1½	"
Musk Tincture	2½	"
Cassie	1½	oz.
Jasmine	4	"
Rose	4	"
Tuberose	6	"
	1	lb.

20. Russian Leather

Zibethin (10% solution)	1/16	dr.
Clove Oil	3/16	"
Birch Tar Oil	¼	"
Bergamot Oil	¼	"
Sandal Oil	1¼	"
Styrax Solution	1¼	"
Benzoin Solution	1¾	"
Orris Tincture	11	"
Orange Flower	1	oz
Vanillin Tincture	1½	"
Cassie	5½	"
Rose	7	"
	1	lb.

21. Cyclamen

Vanillin Tincture	½	dr.
Musk Tincture	1½	"
Benzoin Tincture	1½	"
Terpineol	4½	"
Tuberose	12	"
Violet	1¼	oz.
Orange Flower	2½	"
Jasmine	4	"
Rose	7	"
	1	lb.

22. Ess Bouquet

Benzaldehyde	1/16	dr.
Rose Oil	⅛	"
Lavender Oil	3/16	"
Geranium Oil	¼	"
Castor Tincture	⅜	"
Vanillin Tincture	1	"
Musk Tincture	1½	"
Bergamot Oil	1½	"
Cumarin Tincture	3	"
Tuberose	1	oz.
Cassie	1	"
Violet	1½	"
Reseda	1½	"
Rose	4	"
Jasmine	6½	"
	1	lb.

23. Ess Bouquet, London Style

Styrax Solution	½	dr.
Ambergris Tincture	½	"
Lemon Oil	5½	"
Orris Tincture	2⅝	oz.
Jasmine	4	"
Reseda	4	"
Violet	5	"
	1	lb.

Note: The term "Ess Bouquet" is the abbreviated form of "Essence Bouquet."

24. Frangipanni

Vetiver Oil	¼	dr.
Bergamot Oil	½	"
Civet Tincture	1¼	"
Musk Tincture	7	"
Vanillin Tincture	7	"
Heliotropin Tincture	10	"
Cumarin Tincture	14	"
Rose	2½	oz.
Orange Flower	5	"
Jasmine	6	"
	1	lb.

25. Gaultheria (Wintergreen)

Vetiver Oil	2½ dr.
Lavender Oil	7½ "
Wintergreen Oil	14 "
Ambergris Tincture	1½ oz.
Orange Flower	3 "
Cassie	3 "
Rose	7 "
	1 lb.

26. Geisha

Vanillin Tincture	½ dr.
Cumarin Tincture	½ "
Mandarin Oil	1 "
Bergamot Oil	2 "
Civet Tincture	12 "
Orris Tincture	2½ oz.
Jasmine	6 "
Rose	6½ "
	1 lb.

27. Giroflée

Benzaldehyde	¼ dr.
Vanillin	2½ oz.
Orris Tincture	2½ "
Cassie	2½ "
Orange Flower	4 "
Rose	4½ "
	1 lb.

28. Glycinea

Methyl Anthranilate	½ dr.
Rose Oil	1½ "
Linalyl Acetate	3 "
Benzyl Acetate	3 "
Tolu Tincture	6 "
Musk Tincture	10 "
Cassie	3½ oz.
Jasmine	5 "
Rose	6 "
	1 lb.

29. Guard Bouquet

Bergamot Oil	¼ dr.
Clove Oil	½ "
Geranium Oil	1¼ "
Musk Tincture	14 "
Vanillin Tincture	2 oz.
Orange Flower	2½ "
Orris Tincture	3½ oz.
Rose	7 "
	1 lb.

30. Heliotrope

Ylang-Ylang Oil	¼ dr.
Benzyl Acetate	1¼ "
Terpineol	5 "
Heliotropin	5½ "
Musk Tincture	12 "
Vanillin Tincture	12 "
Peru Balsam Tincture	12 "
Rose	3 oz.
Tuberose	3 "
Jasmine	7 "
	1 lb.

31. Honeysuckle

Methyl Anthranilate	1¼ dr.
Benzaldehyde	1¼ "
Geranyl Formate	2½ "
Vanillin Tincture	2½ "
Castor Tincture	3½ "
Orris Oil, Concrete	5 "
Benzoin Tincture	2 oz.
Rose	6 "
Jonquil	7 "
	1 lb.

32. Hovenia (Japanese)

Clove Oil	¼ dr.
Neroli Oil	¼ "
Rose Oil	1 "
Lime Oil	6½ "
Rosemary Oil	3 oz.
Alcohol	12½ "
	1 lb.

33. Huntsman's Nosegay

Musk Tincture		½dr.
Citronella Oil		½ "
Cassie	1 oz.	15 "
Orange Oil	2 "	
Tonka Bean Tincture	4 "	
Rose	8 "	
	1 lb.	

34. Hyacinth

Ylang-Ylang Oil	¼ dr.
Rose Oil	¼ “
Heliotropin	1¼ “
Bergamot Oil	1¼ “
Hyacinthin	2½ “
Terpineol	3 “
Musk Tincture	6 “
Clove Tincture	9½ “
Orris Tincture	1½ “
Tuberose	1½ “
Jasmine	5 “
Alcohol	6½ “
	1 lb.

35. Jasmine

Linaloe Oil	½ dr.
Bergamot Oil	¾ “
Jasmine Oil	¾ “
Jasmine	7⅞ oz.
Alcohol	8 “
	1 lb.

36. Indian Bouquet

Orris Oil Concrete	1/16 dr.
Patchouly Oil	3/16 “
Ambrette Oil	⅛ “
Zibethin (10% solution)	⅝ “
Musk	½ “
Ionone	½ “
Orris Tincture	10 “
Orange Flower	12 “
Jasmine	14½ oz.
	1 lb.

37. Jockey Club

Ambrette Oil	1 dr.
Cassie Oil	1½ “
Rose Oil	3½ “
Linalyl Acetate	6 “
Tolu Tincture	12 “
Musk Tincture	2 oz.
Orris Tincture	2½ “
Jasmine	4½ “
Rose	5 “
	1 lb.

38. Jonquille

Vanillin	12 dr.
Orange Flower	3¾ oz.
Jasmine	5½ “
Tuberose	6 “
	1 lb.

39. Ki-Loe du Japon

Ylang-Ylang Oil	⅛ dr.
Orris Oil, Concrete	¼ “
Vanillin	¼ “
Benzyl Acetate	⅜ “
Linalyl Acetate	¾ “
Terpineol	1 “
Guaiacol	2¼ “
Reseda	2 oz. 11 “
Rose	6 “
Jasmine	7 “
	1 lb.

40. Kiss-Me-Quick

Patchouly Oil	1/16 dr.
Zibethin (10% solution)	3/16 “
Rose Oil	¾ “
Rhodium Oil	2½ “
Linalyl Acetate	3½ “
Musk Tincture	5 “
Castor Tincture	5½ “
Benzoin Tincture	6½ “
Cassie	1½ oz.
Tuberose	1½ “
Violet	2½ “
Rose	3 “
Jonquil	6 “
	1 lb.

41. Lilac, I

Vanillin	⅛ dr.
Hyacinthin	¼ “
Cumarin	⅜ “
Heliotropin	¾ “
Ylang-Ylang Oil	1½ “
Terpineol	6¼ “
Musk Tincture	7 “
Rose	3 oz.
Tuberose	4 “
Jasmine	8 “
	1 lb.

42. Lilac, II

Benzaldehyde	¼	dr.
Civet Tincture	3¾	"
Orange Flower	5¾	oz.
Tuberose	10	"
	1	lb

43. Lilac, Turkish

Rose Oil	1	dr.
Ylang-Ylang Oil	5	"
Benzoin Tincture	8	"
Terpineol	10	"
Cumarin	12	"
Orange Flower	1¾	oz.
Tuberose	2	"
Jonquil	2	"
Rose	2	"
Jasmine	6	"
	1	lb.

44. Lily

Benzaldehyde	⅛	dr.
Jasmine	15⅞	"
Rose	1¼	oz.
Orange Flower	2	oz.
Vanillin Solution	2¾	"
Cassie	3	"
Tuberose	6	"
	1	lb.

45. Linden Flowers

Patchouly Oil	1/16	dr.
Linalyl Acetate	3/16	"
Geranyl Formate	1¼	"
Benzyl Acetate	1½	"
Linden Flower Oil	2	"
Guaiacol	2½	"
Musk Tincture	2½	"
Castor Tincture	5	"
Cumarin Solution	9	"
Rose	12	"
Tuberose	2¾	oz.
Jasmine	3	"
Cassie	8	"
	1	lb.

46. Magnolia

Lemon Oil	¼	dr.
Benzaldehyde	¾	"
Tuberose	1 oz.	15 dr.
Violet	2	"
Orange Flower	4	"
Rose	8	"
	1	lb.

47. Lily of the Valley, I

Cumarin	½	dr.
Ylang-Ylang Oil	½	"
Muguet	1	"
Musk Tincture	1½	"
Terpineol	2½	"
Linalool	5	"
Orange Flower	13	"
Jasmine	3	oz.
Rose	4	"
Lily of the Valley	7½	"
	1	lb.

48. Lily of the Valley, II

Benzaldehyde	½	dr.
Cassie	2¾	oz.
Jasmine	2¾	"
Orange Flower	3	"
Rose	3½	"
Vanillin Tincture	4	"
	1	lb.

49. Lily of the Valley, III

Orris Oil Concrete	¼	dr.
Castor Tincture	7¾	"
Ylang-Ylang Oil	1½	oz.
Jasmine	14	"
	1	lb.

50. Millefleurs

Lemon Oil	¾	dr.
Orange Oil	¾	"
Lavender Oil	1	"
Geranium Oil	1	"
Vetiver Oil	3½	"
Cedar Oil	6	"
Civet Tincture	7	"
Musk Tincture	12	"
Vanillin Tincture	1½	oz.
Orange Flower	2½	"
Jasmine	2½	"
Cassie	3½	"
Violet	4	"
	1	lb.

51. Mimosa

Neroli Oil	4 dr.
Clove Oil	4 "
Ambrette Oil	5 "
Geranium Oil	5 "
Guaiacol	6 "
Cassie	8 "
Jonquil	3 oz.
Tuberose	5 "
Rose	6 "
	1 lb.

52. Mouseline

Musk	5 dr.
Rose Oil	5 "
Neroli Oil	5 "
Sandal Oil	5 "
Bergamot Oil	5 "
Vanillin	7 "
Rose	3 oz.
Jasmine	5 "
Orange Flower	6 "
	1 lb.

53. Musk

Bergamot Oil	4 dr.
Musk	5 "
Geranium Oil	7 "
Civet Tincture	8 "
Cassie	8 "
Musk Tincture	1¼ oz.
Tuberose	1½ "
Jasmine	3 "
Rose	8 "
	1 lb.

54. Myrte

Jasmine	12 dr.
Orange Flower	3 oz.
Tuberose	3 "
Vanillin Solution	3¼ "
Rose	6 "
	1 lb.

55. Narcisse

Rose Oil	½ dr.
Heliotropin	¾ "
Benzyl Acetate	2¼ "
Vanillin Tincture	2½ "
Styrax Solution	3½ "
Jonquil	12½ "
Orange Flower	3 oz.
Tuberose	5 "
Rose	6 "
	1 lb.

56. Navy's Nosegay

Vetiver Oil	½ dr.
Citronella Oil	¾ "
Benzaldehyde	1 "
Mace Oil	1 "
Lemon Oil	2¾ "
Patchouly	1⅝ oz.
Orange Flower	4 "
Rose	4½ "
Alcohol	5½ "
	1 lb.

57. New Mown Hay

Rose	1½ oz.
Jasmine	2½ "
Orange Flower	2½ "
Tuberose	3½ "
Tonka Bean Tincture	6 "
	1 lb.

58. Orange Flower, I

Bergamot Oil	2 dr.
Musk Tincture	2½ "
Neroli Oil	3½ "
Orange Flower Water	8 "
Jasmine	2 oz.
Orange Flower	13 "
	1 lb.

59. Orange Flower, II

Neroli Oil	2 dr.
Alcohol	1 lb.

60. Opoponax

Cinnamon Oil	⅛	dr.
Ionone	⅛	“
Rose Oil	¾	“
Opoponax Resin	1½	“
Musk Tincture	3¾	“
Benzoin Tincture	1⅝	oz.
Rose	2	“
Orange Flower	2½	“
Jasmine	2½	“
Orris Tincture	3	“
Alcohol	4	“
	1	lb.

61. Orchidée

Neroli Oil	1/16	dr.
Ylang-Ylang Oil	3/16	“
Bergamot Oil	¼	“
Cumarin	¼	“
Rhodium Oil	½	“
Musk Tincture	1½	“
Terpineol	1¾	“
Benzoin Tincture	3½	“
Tuberose	2	oz.
Jasmine	3½	“
Violet	4	“
Rose	6	“
	1	lb.

62. Patchouly

Sandal Oil	½	dr.
Bergamot Oil	½	“
Geranium Oil	1	“
Civet Tincture	4	“
Musk Tincture	4½	“
Patchouly Oil	5	“
Cassie	2	oz.
Jasmine	5	“
Rose	8	“
	1	lb.

63. Peau d'Espagne

Birch Tar Oil	1/32	dr.
Rose Oil	⅜	“
Linalyl Acetate	⅜	“
Ylang-Ylang Oil	⅜	“
Vanillin	⅜	dr.
Lavender Oil	1	“
Zibethin Tincture	2½	“
Tolu Tincture	7	“
Orange Flower	2	oz.
Rose	4	“
Jasmine	9¼	“
	1	lb.

64. Peony

Methyl Anthranilate	¼	dr.
Geranium Oil	1¼	“
Musk	1¼	“
Terpineol	3¾	“
Musk Tincture	3½	“
Styrax Tincture	6	“
Vanillin Tincture	1¼	oz.
Orange Flower	2¾	“
Jasmine	3	“
Rose	4	“
Violet	4	“
	1	lb.

65. Pinks (Carnation)

Vanillin Tincture	2	oz.
Cassie	4	“
Orange Flower	4	“
Rose	6	“
	1	lb.

66. Queen of the Night

Ambrette Oil	½	dr.
Cinnamic Alcohol (Styrone)	½	dr.
Ionone	1	“
Benzyl Acetate	3	“
Benzyl Alcohol	5	“
Zibethin Tincture	6	“
Vanillin Tincture	8	“
Cumarin Tincture	1½	oz.
Orange Flower	1½	“
Orris Tincture	3	“
Jonquil	4	“
Jasmine	4½	“
	1	lb.

67. Queen Victoria Bouquet

Lemon Oil	⅜	dr.
Bergamot Oil	⅝	"
Zibethin Tincture	3	"
Orange Flower	1¼	oz.
Cassie	1½	"
Jasmine	1½	"
Tuberose	3	"
Violet	4	"
Rose	4½	"
	1	lb.

68. Reseda (Mignonette)

Sandal Oil	⅛	dr.
Orris Oil, Concrete	¼	"
Basil Oil	¼	"
Ylang-Ylang Oil	¼	"
Reseda Geraniol	¼	"
Musk Tincture	3⅞	"
Orange Flower	7	"
Cassie	12	"
Jasmine	1½	oz.
Rose	3	"
Violet	3	"
Reseda	7	"
	1	lb.

69. Rondeletia

Clove Oil	¼	dr.
Lavender Oil	¾	"
Rose Oil	¾	"
Zibethin Tincture	¾	"
Bergamot Oil	1½	"
Linaloe Oil	1½	"
Sandal Oil	1½	"
Geranium Oil	1½	"
Musk Tincture	3½	"
Vanillin Tincture	8	"
Cumarin Tincture	1¼	oz.
Orris Tincture	2	"
Jasmine	2	"
Rose	4½	"
Orange Flower	5	"
	1	lb.

70. Rose

Linaloe Oil	1	dr.
Guaiac Oil	1	"
Zibethin Tincture	3	dr.
Tolu Tincture	5	"
Cassie	6	"
Jasmine	1½	oz.
Tuberose	2½	"
Rose	11	"
	1	lb.

71. Rose Eglantine

Lemongrass Oil			¼ dr.
Neroli Oil			¼ "
Jasmine	1	oz.	15½ "
Cassie	2	"	
Orange Flower	3	"	
Rose	9	"	
	1	lb.	

72. Rose, Maréchal Niel (Tea Rose)

Ylang-Ylang Oil	½	dr.
Clove Oil	½	"
Lemon Oil	½	"
Sandal Oil	1	"
Thyme Oil	1	"
Rose Oil	4	"
Ambergris Tincture	7½	"
Musk Tincture	8	"
Orange Flower	9	"
Orris Tincture	1	oz.
Tuberose	1½	"
Jasmine	1½	"
Rose	10	"
	1	lb.

73. Rose, Moss

Heliotropin	½	dr.
Bergamot Oil	½	"
Rose Oil	1	"
Zibethin Tincture	1	"
Benzoin Tincture	5	"
Rose	15½	oz.
	1	lb.

74. Rose, White

Patchouly Oil	¼	dr.
Bergamot Oil	½	"
Geranium Oil	½	"
Linaloe Oil	½	"
Sandal Oil	¾	"
Benzoin Tincture	10½	"
Tuberose	11	"
Cassie	1	oz.
Rose	13½	"
	1	lb.

5. Royal Horseguard Bouquet

Pimenta Oil	¼	dr.
Orris Tincture	11¾	"
Musk Tincture	12	"
Vanillin Tincture	1	oz.
Orange Flower	1½	"
Violet	12	"
	1	lb.

76. Royal Nosegay

Vetiver Oil	¼	dr.
Bergamot Oil	3¾	"
Clove Oil	8	"
Musk Tincture	1	oz.
Ambergris Tincture	1	"
Vanillin Tincture	1	"
Jasmine	3½	"
Rose	4	"
Violet	5	"
	1	lb.

77. Spring Flower

Orris Oil, Concrete	¼	dr.
Linalyl Acetate	½	"
Coriander Oil	¾	"
Ylang-Ylang Oil	2½	"
Basil Oil	2½	"
Clove Oil	2½	"
Zibethin Tincture	7	"
Musk Tincture	8	"
Vanillin Tincture	8	"
Cassie	1½	oz.
Violet	2	"
Orange	3	"
Jasmine	3	"
Rose	4½	"
	1	lb.

78. Spring Nosegay

Musk Tincture	10	dr
Ambergris Tincture	14	"
Cassie	2½	oz.
Rose	2½	"
Jasmine	2½	"
Tuberose	2½	"
Orange	4½	"
	1	lb.

79. Stephanotis

Lemon Oil	⅛	dr.
Rose Oil	½	"
Ylang-Ylang Oil	½	"
Linalyl Acetate	1⅞	"
Musk Tincture	9	"
Cassie	1¼	oz.
Orris Tincture	3½	"
Rose	4½	"
Jasmine	6	"
	1	lb.

80. Sweet Pea

Cumarin Tincture	½	dr.
Musk	½	"
Ionone	1	"
Guaiac Oil	1	"
Vanillin Tincture	1½	"
Hyacinthin	1½	"
Heliotropin	4	"
Terpineol	10	"
Rose	1¾	oz.
Orange Flower	2	"
Jasmine	11	"
	1	lb.

81. Trèfle (Trefoil)

Cumarin	½	dr.
Methyl Salicylate	½	"
Ylang-Ylang Oil	¾	"
Rose Oil	¾	"
Musk Tincture	2½	"
Benzoin Tincture	5	"
Rose	2½	oz.
Jonquil	6	"
Tuberose	7	"
	1	lb.

82. Tulip

Benzaldehyde	$\frac{1}{16}$	dr.
Neroli Oil	$\frac{3}{16}$	"
Cassie	$11\frac{3}{4}$	"
Rose	$2\frac{1}{4}$	oz.
Jasmine	3	"
Tuberose	4	"
Orris Tincture	6	"
	1	lb.

83. Verbena, I (Verveine)

Lemon Oil	$\frac{1}{2}$	dr.
Citronella Oil	$4\frac{1}{2}$	"
Amyl Acetate	5	"
Lime Oil	6	"
Rose	2	oz.
Orange Flower	2	"
Tuberose	$2\frac{1}{2}$	"
Alcohol	$8\frac{1}{2}$	"
	1	lb.

84. Verbena, II

Citronella Oil	$\frac{3}{4}$	dr.
Orange Oil	$\frac{3}{4}$	"
Lime Oil	$6\frac{1}{2}$	"
Alcohol	$15\frac{1}{2}$	oz.
	1	lb.

85. Vine Flower

Ethyl Œnanthate	$\frac{1}{4}$	dr.
Ylang-Ylang Oil	$\frac{3}{4}$	"
Zibethin Tincture	$\frac{3}{4}$	"
Vanillin Tincture	$1\frac{3}{4}$	"
Cinnamic Alcohol	$1\frac{1}{2}$	"
Benzoin Tincture	7	"
Rose	$3\frac{1}{4}$	oz.
Jasmine	12	"
	1	lb.

86. Violet, Parme

Orris Oil, Concrete	$\frac{1}{4}$	dr.
Ylang-Ylang Oil	$\frac{1}{2}$	"
Ionone	$\frac{3}{4}$	"
Guaiac Oil	$6\frac{1}{2}$	"
Rose	1	oz.
Jasmine	$2\frac{1}{2}$	"
Violet	12	"
	1	lb.

87. Violet, Riviera

Linalyl Acetate	$\frac{1}{2}$	dr.
Benzyl Acetate	1	"
Musk Tincture	1	"
Ionone	$2\frac{1}{2}$	"
Benzoin Tincture	11	"
Rose	1	oz.
Cassie	$1\frac{1}{2}$	"
Violet	$12\frac{1}{2}$	"
	1	lb.

88. Violet, Wood

Ethyl Acetate	$\frac{1}{8}$	dr.
Vanillin	$\frac{1}{8}$	"
Orris Oil, Concrete	$\frac{1}{4}$	"
Ionone	$\frac{3}{4}$	"
Ylang-Ylang Oil	$\frac{3}{4}$	"
Guaiac Oil	1	"
Musk Tincture	8	"
Orange Flower	13	"
Orris Tincture	$2\frac{1}{2}$	oz.
Jasmine	3	"
Violet	9	"
	1	lb.

89. Violet, Artificial

Zibethin Tincture	$\frac{1}{8}$	dr.
Orris Oil, Concrete	$\frac{1}{8}$	"
Musk Tincture	1	"
Linalyl Acetate	$1\frac{1}{4}$	"
Ionone	$1\frac{1}{2}$	"
Jasmine	7	"
Reseda	9	"
Cassie	$1\frac{1}{4}$	oz.
Rose	$1\frac{1}{2}$	"
Alcohol	2	"
Orris Tincture Distillate	10	"
(3 parts tincture yield 2 parts distillate)	1	lb.

90. Volkmeria

Musk Tincture	12	dr.
Jasmine	$1\frac{1}{4}$	oz.
Rose	3	"
Tuberose	5	"
Violet	6	"
	1	lb.

91. West End Bouquet

Lemon Oil	¼ dr.
Bergamot Oil	1¼ "
Ambergris Tincture	7 "
Musk Tincture	7½ "
Cassie	2¼ oz.
Jasmine	2¼ "
Tuberose	2½ "
Violet	3½ "
Rose	4½ "
	1 lb.

92. Yacht Club

Sandal Oil	1 dr.
Benzoic Acid, True, Sublimed	2 "
Cassie	13 "
Vanillin Tincture	2½ oz.
Rose	3½ "
Orange	3½ oz.
Jasmine	5½ "
	1 lb.

93. Ylang-Ylang

Niobe Oil	1/16 dr.
Musk	1/16 "
Benzaldehyde	1/16 "
Cananga Oil	3/16 "
Linalyl Acetate	1¼ "
Terpineol	1½ "
Ylang-Ylang Oil	1⅝ "
Benzoin Tincture	2¼ "
Cassie	9 "
Jonquil	3 oz.
Orris Tincture	3½ "
Tuberose	3½ "
Jasmine	5 "
	1 lb.

IV. AROMATIC WATERS

This class of perfumes comprises simple solutions of volatile oils, being represented by Eau de Cologne as a type. In the formulas here given only the volatile oils are mentioned. The quantity of alcohol required for their dilution is in each case calculated to yield 1 lb., using the quantity of essence stated. In cases where the essences are to be furnished from which to prepare the waters, the mixtures are best diluted by mixing the quantity required per pound of water with enough alcohol to make 2 oz. by weight; directions are then to be given to mix the 2 oz. with strong alcohol to make 1 lb. of finished product.

94. Court Water

(¾ oz. per pound)

Pineapple Ether	1½ dr.
Musk Tincture	1½ "
Orris Oil, Concrete	1½ "
Cumarin	3 "
Ambergris Tincture	4 "
Neroli Oil	4½ "
Rose Extract	5½ oz.
Bergamot Oil	9½ "
	1 lb.

95. Eau de Cologne, I

(6 dr. per pound)

Rose Oil	2 dr.
Melissa Oil	2 "
Neroli Oil	5 "
Lavender Oil	6 "
Geranium Oil	8 "
Rosemary Oil	9 "
Lime Oil	1 oz.
Cedrat Oil	2 "
Petitgrain Oil	2 "
Orange Oil	2 "
Lemon Oil	3 "
Bergamot Oil	4 "
	1 lb.

96. Eau de Cologne, II

(6 dr. per pound)

Melissa Oil	2 dr.
Lavender Oil	6 "
Rosemary Oil	8 "
Neroli Oil	1 oz.
Orange Oil	1½ "
Petitgrain Oil	2 "
Lemon Oil	4½ "
Bergamot Oil	6 "
	1 lb.

97. Eau de Cologne, Lilac

(¾ oz. per pound)

Hyacinthin	2½ dr.
Jasmin Oil, Artificial	13½ "
Benzyl Acetate	2 oz.
Terpineol	5 "
Eau de Cologne Oil, I	8 "
	1 lb.

98. Eau de Cologne, Lily of the Valley

(¾ oz. per pound)

Coriander Oil	1 dr.
Jasmine Oil, Artificial	11 "
Terpineol	3¼ oz.
Linalool	5 oz.
Eau de Cologne Oil, I	7 "
	1 lb.

99. Eau de Cologne, Rose

(¾ oz. per pound)

Rose Oil	2½ dr.
Rose Geraniol	13½ "
Geranium Oil	1½ oz.
Eau de Cologne Oil, I	13½ "
	1 lb.

100. Eau de Cologne, Violet

(¾ oz. per pound)

Ylang-Ylang Oil	5 dr.
Ionone	1 oz. 11 "
Eau de Cologne Oil, I	13 "
	1 lb.

101. Hungarian Water

(6 dr. per pound)

Niobe Oil	1 dr.
Neroli Oil	3½ "
Rose Oil, Artificial	7½ "
Melissa Oil	4 oz.
Lemon Oil	4¼ "
Rose Extract	7 "
	1 lb.

V. TOILET WATERS

These are primarily intended to be added to the bath, or to the ash water. They too are prepared exclusively from volatile oils, and here too only the volatile oils are mentioned, and in the proportions in which they are to be diluted with strong alcohol. In supplying essences from which the finished preparations are to be made, the quantities required for 1 lb. are to be diluted with strong alcohol in each case to make 2 oz. by weight; directions are then to be given to mix the 2 oz. with strong alcohol to make 1 lb. of finished product.

102. Cananga Water

(¾ oz. per pound.)

Methyl Salicylate	2 dr.
Citronella Oil	2 "
Patchouly Oil	4 "
Clove Oil	4 dr.
Geranium Oil	4 oz.
Cananga Oil	5¼ "
Bergamot Oil	6 "
	1 lb.

103. Florida Water

(¾ oz. per pound.)

Neroli Oil	6 dr.
Clove Oil	6 "
Sweet Orange Oil	10 "
Cassia Oil	10 "
Lemon Oil	1½ oz.
Bergamot Oil	1½ "
Lavender Oil	11 "
	1 lb.

104. Lavender Water

(6 dr. per pound.)

Cumarin	4 dr.
Musk	8 "
Geranium Oil	8 "
Lavender Oil	14¾ oz.
	1 lb.

105. Lavender Water, Double

(¾ oz. per pound.)

Orris Oil, Concrete	2 dr.
Neroli Oil	5 "
Geranyl Acetate	5 "
Orange Oil	5 "
Peru Balsam	6 "
Clove Oil	9 "
Benzoin Tincture	1 oz.
Tolu Tincture	1 "
Bergamot Oil	2 "
Lemon Oil	2 "
Lavender Oil	6 "
Alcohol	2 "
	1 lb.

106. Lavender Water with Ambergris (Eau de Vie de Lavende Ambrée)

(¾ oz. per pound.)

Orris Oil, Concrete	1 dr.
Musk	1½ "
Lemon Oil	5½ "
Peru Balsam	1 oz.
Bergamot Oil	1 "
Styrax Solution	2 "
Tolu Balsam Solution	2 "
Lavender Oil	2½ "
Benzoin Tincture	3 oz.
Alcohol	4 "
	1 lb.

107. Lisboa Water

(¾ oz. per pound.)

Rose Oil	8 dr.
Lemon Oil	4½ oz.
Portugal Oil	7 "
Alcohol	4 "
	1 lb.

108. Portugal Water

(6 dr. per pound.)

Neroli Oil	2 dr.
Lemon Oil	10 "
Bergamot Oil	1¼ oz.
Orange Oil	14 "
	1 lb.

109. Toilet Water, Lilac

(1½ dr. per pound.)

Rose Oil	6 dr.
Jasmin Oil	10 "
Niobe Oil	1 oz.
Cumarin	1½ "
Terpineol	12½ "
	1 lb.

110. Toilet Water, Lily of the Valley

(1½ dr. per pound.)

Linalool	1½ oz.
Jasmin Extract	3 "
Terpineol	3½ "
Lily of the Valley Extract	8 "
	1 lb.

111. Toilet Water, Rose

(1½ dr. per pound.)

Rose Oil	2½ oz.
Sandal Oil	3 "
Benzyl Acetate	4 "
Bergamot Oil	6½ "
	1 lb.

112. Toilet Water, Violet

(1½ dr. per pound.)

Musk	2½	dr.
Cumarin	7½	"
Orris Tincture	10	"
Ionone	2	oz.
Benzyl Acetate	4	"
Jasmine Extract	8¾	"
	1	lb.

113. Verbena Water

(6 dr. per pound.)

Clove Oil	5	dr.
Geranium Oil	11	"
Peru Balsam	1¼	oz.
Benzoin Tincture	2	"
Tolu Solution	2¾	"
Verbena Oil	6	"
Alcohol	3	"
	1	lb.

VI. TOILET VINEGARS

The essences for toilet vinegars are strong concentrations, which are to be diluted in the proportion of 1½ oz. with enough alcohol to make 1 lb. finished product.

114. Toilet Vinegar

Neroli Oil	1¼	dr.
Rose Oil	2¾	"
Vanillin Solution	8	"
Lemon Oil	1¼	oz.
Bergamot Oil	1½	"
Acetic Acid (80%)	3½	"
Benzoin Tincture	9	"
	1	lb.

115. Four-Thieves Vinegar

Calamus Root	¾	oz.
Mace	¾	"
Nutmeg	¾	"
Camphor	1½	"
Lavender Flowers	7½	"
Peppermint Leaves	7½	"
Rue Leaves	7½	"
Rosemary Leaves	7½	"
Cinnamon Bark	7½	"

Macerate with

Alcohol	10	lb.
Acetic Acid (80%)	2	"

After 8 days express off 10 lb. essence.

116. Toilet Vinegar, Rose

Musk	2½	dr.
Rose Oil	1	oz.
Ethyl Acetate	1	" 13½ dr.
Geranium Oil	4	"
Alcohol	5½	"
Acetic Acid (80%)	3½	"
	1	lb.

117. Toilet Water, Violet

Rose Oil	2½	dr.
Acetic Ether	9½	"
Ionone	2	oz.
Benzyl Acetate	2¼	"
Benzoin Tincture	7½	"
Acetic Acid (80%)	3½	"
	1	lb.

VII. DRY PERFUMES

The concentration of an odorous substance in the form of a *dry* perfume is effected by impregnating a mass with the various odorous substances. If this is done using a pasty mass, which is dried out after impregnating, we can obtain the dry perfume in the form of a *tablet perfume.* The smelling salts are similarly made, by adding the odorous substances to volatile ammonium

salts and keeping the mixture in bottles from which the mixture is inhaled. Peau d'Espagne is likewise a peculiar form of dry perfume.

(a) *Tablet Perfumes*

118. Base Mass for Violet

Rice Starch	2	oz.
Magnesium Carbonate	2	"
Calcium Carbonate	3½	"
Orris Root Powder	5	"
Glucose, Syrupy	3½	"

Mix to form a paste, which then dry, and impregnate with the desired odorous mixture.

119. Base Mass for All Other Odors

Orris Root Powder	¾	oz.
Dextrin	1¼	"
Magnesium Carbonate	1¼	"
Calcium Carbonate	1½	"
Starch Powder	5	"
Glucose, Syrupy	2	"

Mix and treat as above. *Note:* The odorous mixture is added in the proportion of ½ dr. per pound of base mass.

120. Heliotrope for Tablets

Benzaldehyde	2½	dr.
Heliotropin	5½	"
Heliotrope Extract	1½	oz.
Musk Tincture	1½	"
Benzoin Tincture	6½	"
Alcohol	6	"
	1	lb.

121. Lilac for Tablets

Musk Tincture	1¼	dr.
Rose Oil	2	"
Hyacinthin	5	"
Geranium Oil	5	"
Cananga Oil	6¾	"
Benzyl Acetate	2¾	oz.
Benzoin Tincture	4	"
Terpineol	8	"
	1	lb.

122. Lily of the Valley for Tablets

Ylang-Ylang Oil	6	dr.
Bergamot Oil	6	"
Musk Tincture	2¼	oz.
Linalool	3½	"
Benzoin Tincture	3½	"
Terpineol	6	"
	1	lb.

123. Violet for Tablets

Ylang-Ylang Oil	3½	dr.
Rose Oil	3½	"
Benzoin Tincture	5	"
Sandal Oil	12	"
Ionone	1	oz.
Linalyl Acetate	3½	"
Guaiac Oil	4	"
Benzoin Tincture	6	"
	1	lb.

(b) *Sachets*

124. Sachet Base (Powder)

Sandal Wood Powder	¾	oz.
Benzoin Powder	¾	"
Cinnamon Powder	1½	"
Rose Leaves Powder	3	"
Orris Root Powder	10	"
	1	lb.

Note: The odorants for sachets are always triturations of the corresponding oil or odorous substance with powdered benzoin; of this trituration 1½ dr. is used per pound of base.

125. Heliotrope for Sachets

Benzaldehyde	6 dr.
Musk	10 "
Vanillin	1¼ oz.
Heliotropin	6 "
Benzoin Powder	7¾ "
	1 lb.

126. Lilac for Sachets

Musk	6 dr.
Ionone	6 "
Terpineol	2¼ oz.
Benzoin Powder	13 "
	1 lb.

127. Rose for Sachets

Musk	8 dr.
Rose Oil	12 "
Bergamot Oil	12 "
Benzoin Powder	14 oz.
	1 lb.

128. Violet for Sachets

Ylang-Ylang Oil	5 dr.
Ionone	1¼ oz.
Benzoin Powder	14 " 7 dr.
	1 lb.

(c) *Peau d'Espagne*

Ordinary chamois skin is beaten until soft, and then allowed to stand immersed in the following mixture for 4 to 6 days. It is then lightly expressed, and allowed to dry while kept stretched, whereupon it is cut into pieces of suitable size and thus marketed; or small pieces are sewn into silk bags. It serves for perfuming clothes closets, etc.:

129. Essence for Peau d'Espagne

Pimenta Oil	2½ dr.
Neroli Oil	5 "
Cumarin	5 "
Bergamot Oil	5 "
Sandal Oil	5 "
Lavender Oil	6 "
Rose Oil	7½ dr.
Linalyl Acetate	10 "
Vanillin	10 "
Geranium Oil	1½ oz.
Musk Tincture	4 "
Benzoin Tincture	7 "
	1 lb.

(d) *Smelling Salts*

The odorous mixtures are poured over dried ammonium carbonate, which is contained in suitable bottles. A definite quantity cannot well be stated, but enough should be used for the salt to become fully saturated with it.

130. Lavender Smelling Salts

Musk Tincture	5 dr.
Rose Extract	5 "
Lavender Oil	3⅝ oz.
Alcohol	12 "
	1 lb.

131. Smelling Salts

Patchouly Oil	¼ oz.
Bergamot Oil	1¾ "
Geranium Oil	2 "
Lavender Oil	12 "
	1 lb.

VIII. FUMIGANTS

(a) *For Ordinary Fumigation*

132. Fumigating Essence
(1½ oz. per pound)

Lavender Oil	1½ dr.
Cassia Oil	2½ "
Clove Oil	2½ "
Bergamot Oil	2½ "
Peru Balsam	11 "
Jasmine Extract	1¾ oz.
Benzoin Tincture	3 "
Styrax Solution	5 "
Tolu Solution	5 "
	1 lb.

133. Fumigating Vinegar
(1½ oz. per pound)

Acetic Acid (80%)	2½ oz.
Fumigating Essence	13½ "
	1 lb.

134. Fumigating Paper

For making this an uncalendered paper is used, and the paper is impregnated with a concentrated solution of potassium nitrate, if it is to be burned, and if not, it is treated with a solution of alum, and then dried, after which it is dipped into the following essence:

Musk	¾ dr.
Cumarin	¾ "
Lemon Oil	1½ "
Peru Balsam	1½ "
Clove Oil	3 "
Lavender Oil	3 "
Geranium Oil	4½ "
Bergamot Oil	7 "
Myrrh Tincture	10 "
Styrax Solution	1 oz.
Cascarilla Bark Tincture	2 "
Sandarac Solution	3 "
Benzoin Tincture	8 "
	1 lb

(b) *Room Sprays*

135. Eucalyptus Spray

Geranium Oil	½ dr.
Terpineol	2 oz.
Quinosol	4 "
Eucalyptus Oil	6 "
Alcohol	4 "
	1 lb.

136. Pine Needle Spray

Lavender Oil	¾ oz.
Bergamot Oil	¾ "
Pinus Pumilio Oil	5 "
Silver Fir Oil	9½ "
	1 lb.

B. Cosmetic Essences

The true cosmetic essences are used in the care of the various parts of the body, such as the mouth, teeth, nails, skin, hair, and beard. No attention will here be paid to the so-called "beauty remedies," and of the others, only the most important will be treated of in so far as essences or odorous compositions are required in their preparation. Only in individual cases will the bases of the finished product be given, with which the odorous compound is to be mixed.

I. CARE OF THE MOUTH

(a) *Mouthwashes (Essences for Making Them)*

These are made by mixing the quantity ordered to be used per pound, with sufficient alcohol to make this quantity. Where essences are to be marketed from which the washes are to be made, the preparation is to be diluted with alcohol so that 2 oz. of the product will contain the quantity of the preparation required for 1 lb. of finished product; these 2 oz. are then of course to be mixed with alcohol to make 1 lb.

137. Anatherin Mouthwash

(¾ oz. per pound.)

Rose Oil	1½ dr.
Cinnamon Oil	1½ "
Mace Oil	1½ "
Santal Oil	2½ "
Pimenta Oil	2½ "
Guaiac Oil	3½ "
Myrrh Tincture	4 oz. 3 dr.
Alcohol	11 "
	1 lb.

138. Quinosol Mouthwash

(2½ dr. per pound.)

Cinnamon Oil	5 dr.
Quinosol	1 oz.
Anethol	1 "
Peppermint Oil	3 oz. 11 dr.
Alcohol	10 oz.
	1 lb.

139. Eau de Botot

(2½ dr. per pound.)

Peppermint Oil	6 dr.
Mace Oil	6 "
Cinnamon Oil	12 "
Clove Oil	1½ oz.
Ambergris Tincture	5 "
Alcohol	8 "
	1 lb.

140. Eucalyptus Mouthwash

(2½ dr. per pound.)

Peppermint Oil	12 dr.
Geranium Oil	12 "
Salol	1½ oz.
Eucalyptus Oil	4 "
Alcohol	9 "
	1 lb.

141. Salol Mouthwash

(1½ oz. per pound.)

Cinnamon Oil	1 dr.
Clove Oil	2½ "
Anethol	3½ "
Mace Oil	5 "
Salol	2¼ oz.
Benzoin Tincture	2½ "
Alcohol	10½ "
	1 lb.

142. Thymol Mouthwash

(1½ oz. per pound.)

Peppermint Oil	3 dr.
Eucalyptus Oil	6 "
Myrrh Tincture	13 "
Thymol	1½ oz.
Benzoin Tincture	3 "
Alcohol	10 "
	1 lb.

(b) *Cachous*

These serve to perfume the mouth and the breath. The base is a paste mass which is dried after having been mixed with the

odorous constituent in the proportion of ¼ dr. per pound just before it becomes too hard. The paste mass consists of a mixture of 1 part gum solution, 2 parts powdered sugar and 2 parts milk sugar.

143. Cachous

(¼ dr. per pound.)

Vanillin	12 dr.
Civet Tincture	3¼ oz.
Rose Oil	3½ oz.
Geranium Oil	6 "
Alcohol	2½ "
	1 lb.

II. CARE OF THE TEETH

(a) *Toothpastes*

144. Toothpaste Base

Soap, Powdered	1¼ oz.
Glycerin	3¼ "
Magnesium Carbonate	3½ "
Calcium Carbonate	8 "
	1 lb.

For this there is required 1½ dr. perfume made as follows:

145. Eucalyptus for Toothpaste

Geranium Oil	3 oz.
Benzyl Acetate	3 "
Eucalyptus Oil	10 oz.
	1 lb.

146. Peppermint for Toothpaste

Cinnamon Oil	3 oz.
Anethol	6½ "
Peppermint Oil	6½ "
	1 lb.

(b) *Toothpowder*

147. Toothpowder Base

Milk Sugar	1¼ oz.
Magnesium Carbonate	4½ "
Calcium Carbonate	10¼ "
	1 lb.

To every 10 lb. of this base add oz. of perfume made as follows:

148. Eucalyptus for Toothpowder

Eucalyptol	4 oz.
Geranium Oil	6 "
Benzyl Acetate	6 "
	1 lb.

149. Peppermint for Toothpowder

Peppermint Oil	3 oz.
Anise Oil	6½ "
Clove Oil	6½ "
	1 lb.

(c) *Toothsoap Cream*

The cream has the following composition:

Milk Sugar	¾ oz.
Water	1¼ "
Soap Powder	1½ "
Glycerin	3½ "
Magnesium Carbonate	3½ "
Calcium Carbonate	5½ "
	1 lb.

150. Perfume for Toothsoap Cream

(1½ dr. per pound.)

Peppermint Oil	5 oz.
Eucalyptus Oil	5 "
Clove Oil	6 "
	1 lb.

III. CARE OF THE NAILS

151. PERFUME FOR NAIL POWDER

Ylang-Ylang Oil	¾ oz.
Vanillin	1½ "
Geranium Oil	6¾ oz.
Terpineol	7 "
	1 lb.

IV. CARE OF THE SKIN

(a) *Perfumes for Skin Creams*

152. GLYCERIN CREAM

(6 dr. per pound cream)

Hyacinthin	1 oz.
Anisaldehyde	2 "
Benzyl Acetate	3 "
Terpineol	10 "
	1 lb.

153. LANOLIN CREAM

Vanillin	½ oz.
Lavender Oil	1½ "
Geraniol	4 "
Terpineol	10 "
	1 lb.

154. TOILET CREAM

Zibethin (10% solution)	½ oz.
Lavender Oil	1¼ "
Linalool	3¼ "
Musk Tincture	3½ "
Geranium Oil	3½ "
Benzyl Acetate	4 "
	1 lb.

155. VASELIN CREAM

Anisaldehyde	¾ oz.
Jasmine Oil, Artificial	1¼ "
Cananga Oil	2½ "
Jasmine Extract	2½ "
Benzyl Acetate	9 "
	1 lb.

(b) *Toilet Powder Perfume*

156. FAT POWDER

(2½ dr. per pound)

Heliotropin	¾ oz.
Jasmine Oil, Artificial	¾ "
Geranium Oil	4½ "
Musk Tincture	4 "
Rose Extract	6 "
	1 lb.

157. RICE POWDER

Rose Oil	¾ oz.
Benzaldehyde	1½ "
Bergamot Oil	1½ "
Rose Extract	4¼ "
Musk Tincture	8 "
	1 lb.

V. CARE OF THE HAIR

(a) *Hair Oil Perfumes*

158. HAIR OIL PERFUME, I

(2½ dr. per pound)

Cinnamon Oil	¾ oz.
Cassia Oil	¾ "
Lemon Oil	2¼ "
Terpineol	2¼ "
Amyl Valerate Solution	2½ "
Rose Geranium Oil	2½ "
Bergamot Oil	5 "
	1 lb.

159. HAIR OIL PERFUME, II

Cassia Oil	2½ oz.
Orange Oil	2½ "
Lemon Oil	5 "
Rose Geranium Oil	6 "
	1 lb.

160. Arnica Hair Oil

Terpineol	1½ oz.
Rose Geranium Oil	3¼ "
Bergamot Oil	3¼ "
Arnica Oil	8 "
	1 lb.

161. Burdock Hair Oil

Lavender Oil	2 oz.
Clove Oil	3 "
Rose Geranium Oil	3½ "
Bergamot Oil	3½ "
Lemon Oil	4 "
	1 lb.

162. Flower Hair Oils

These are made exclusively from mixtures of the true flower oils.

163. Macassar Hair Oil

Rose Oil	¾ oz.
Ceylon Cinnamon Oil	2 "
Clove Oil	3 "
Bergamot Oil	10¼ "
	1 lb.

(b) *Pomade Perfume Oils*

These are used in the proportion of 1 dr. per pound pomade. The hair oil perfumes may also be used, but only in the larger quantities here given.

164. Pomade Oil for Domestic or Export Trade

Lemon Oil	5 oz.
Citronella Oil	5½ "
Cassia Oil	5½ "
	1 lb.

165. Apple Pomade

Zibethin (10% solution)	4 dr.
Lemon Oil	4¾ "
Lavender Oil	4 "
Orange Oil	7 "
Amyl Valerate Solution	15 oz.
	1 lb.

166. China Pomade

Geranium Oil	1 oz.
Clove Oil	4 "
Bergamot Oil	4 "
Peru Balsam	7 "
	1 lb.

167. Flower Pomades

These are made exclusively from the true flower pomades, and sometimes from these pomades after they have been washed in making triple extracts.

168. Ice Pomade

Geranium Oil	4 oz.
Bergamot Oil	6 "
Lemon Oil	6 "
	1 lb.

169. Marrow Pomade

Cassia Oil	1½ oz.
Lavender Oil	1½ "
Orange Oil	2½ "
Bergamot Oil	3½ "
Lemon Oil	7 "
	1 lb.

170. Strawberry Pomades

Terpineol	2 oz.
Rose Geranium Oil	2½ "
Strawberry Essence	11½ "
	1 lb.

(c) *Stick Pomades*

171. Base for Stick Pomades

Ceresin	1½ oz.
Tallow	3 "
Vaselin	5 "
Colophony	6½ "
	1 lb.

172. Perfume for Cosmetiques (2½ dr. per pound)

Geranium Oil	1½ oz.
Clove Oil	2 "
Bergamot Oil	2½ "
Rose Geranium Oil	5 "
Terpineol	5 "
	1 lb.

(d) *Hair Creams*

173. Base for Hair Creams

Colophony....
Tallow....
Spermaceti....
Vaselin.......equal parts

174. Perfume for Hair Creams (1 dr. per pound)

Cassia Oil	1½ oz.
Bergamot Oil	2 "
Citronella Oil	2 "
Clove Oil	2½ "
Lavender	3 "
Lemon Oil	5 "
	1 lb.

(e) *Bandolines*

175. Base for Bandolines

Tragacanth	½ oz.
Alcohol	2½ "

Let stand for 1 day, then add

Cold Water	11 oz.

When the mixture is quite homogeneous, pass through a strainer, and add the perfume.

176. Perfume for Bandolines

Benzaldehyde	4 oz.
Bergamot Oil	5 "
Geranium Oil	7 "
	1 lb.

(f) *Hair Washes*

These serve for softening the hair and stimulating its growth. For the so-called "hair growers," however, no formulas will be given here. For these there are usually employed tincture of cinchona and tincture of cantharides, the latter being rather toxic. Here will be given only the perfume compounds which are to be made up with strong alcohol. For essences, and for preparations to be completed by the consumer, the quantities of the compound, wherever 2½ dr. of these are required per pound of finished product, are to be added to 13½ oz. alcohol; and are to be marked that 1 oz. is to be diluted with alcohol to make 1 lb. (The mixtures are to be employed in the proportion of 2½ dr. per pound.)

177. Bay Rum (Foaming)

Pimenta Oil	¾	oz.
Bay Oil	3¾	"
Genuine Rum	5	"
Ammonia Water	3	"
Alcohol	3½	"
	1	lb.

178. Birch Hair Wash

Terpineol	¾	oz.
Bergamot Oil	¾	"
Geranium Oil	1	"
Glycerin	4	"
Alcohol	4	"
Birch Bud Oil	5½	"
	1	lb.

179. Eau de Quinine

Neroli Oil	1½	dr.
Vanillin	2½	"
Bergamot Oil	10	"
Lemon Oil	10	"
Geranium Oil	1¼	oz.
Peru Balsam	1¼	"
Rose Extract	1½	"
Tincture Cinchona	10½	"
	1	lb.

180. Florida Water

Cumarin	1½	dr.
Neroli Oil	2½	"
Orange Oil	4	"
Jasmine Extract	3½	oz.
Rose Extract	4	"
Cassie Extract	8	"
	1	lb.

181. Honey Water

Honey Flavor Oil	1¼	dr.
Rose Oil	1¼	"
Neroli Oil	2½	"
Bergamot Oil	11	"
Glycerin	2	oz.
Alcohol	13	"
	1	lb.

182. Ice Hair Wash

Ethyl Acetate	6	dr.
Geranium Oil	6	"
Bergamot Oil	1¼	oz.
Menthol	3	"
Alcohol	11	"
	1	lb.

In making the following semi-medicinal hairwashes the proportion to be employed is 1½ oz. per pound.

183. Naphthol Hair Wash

Orris Oil, Concrete	⅛	dr.
Heliotropin	2⅞	"
Betanaphthol	4	oz.
Alcohol	12	"
	1	lb.

184. Philodermin Hair Wash

Ylang-Ylang Oil	1¼	dr.
Methyl Anthranilate	1¼	"
Orange Oil	1½	"
Lavender Oil	2½	"
Lemon Oil	2½	"
Bergamot Oil	11	"
Glycerin	1¾	oz.
Cantharides Tincture	8	oz.
Alcohol	5	"
	1	lb.

185. Shampoo Hair Wash

Clove Oil	1½	dr.
Geranium Oil	1½	"
Terpineol	2½	"
Lemon Oil	2½	"
Ammonium Chloride	4	"
Borax	6	"
Potassium Carbonate	14	"
Ammonia Water	1	oz.
Water	5	"
Alcohol	8	"
	1	lb.

186. Dandruff Hair Wash

Geranium Oil	6 dr.
Bergamot Oil	6 "
Orange Oil	10 "
Resorcin	10 "
Cantharides Tincture	1½ oz.
Cinchona Tincture	3½ "
Alcohol	9 "
	1 lb.

187. Violet Hair Wash

(2½ dr. per pound.)

Rose Oil	½ oz.
Jasmin Oil, Artificial	1 "
Orris Oil, Concrete	1 "
Bergamot Oil	2¼ "
Ionone	2¼ "
Benzyl Acetate	2½ "
Alcohol	6½ "
	1 lb.

VI. CARE OF THE BEARD

(a) *Brilliantines*

188. Base for Liquid Brilliantine

Castor Oil	equal parts
Alcohol	

189. Base for Crystal Brilliantine

Spermaceti	3 oz.
Olive Oil	13 "

Melt together.

For either of the above 2½ dr. perfume is used per pound.

190. Brilliantine Perfume

Cinnamon Oil	1 oz.
Geranium Oil	2½ "
Terpineol	2½ "
Linalool	4 "
Bergamot Oil	6 "
	1 lb.

191. Lilac Brilliantine

Hyacinthin	2 oz.
Aubépin	3 "
Benzyl Benzoate	5 oz.
Terpineol	6 "
	1 lb.

192. Lily of the Valley Brilliantine

Ylang-Ylang Oil	½ oz.
Linalool	4½ "
Terpineol	5 "
Lily of the Valley Extract	6 "
	1 lb.

193. Rose Brilliantine

Rose Oil	½ oz.
Bergamot Oil	3½ "
Geranium Oil	12 "
	1 lb.

194. Violet Brilliantine

Ionone	2½ oz.
Benzyl Benzoate	6½ "
Bergamot Oil	7 "

(b) *Mustache or Beard Fixative (Pommade Hongroise)*

195. Base for Beard Fixative

Colophony	12 dr.
Japan Wax	3 oz.
Melt, and while hot add	
Soap Powder	4 "
Solution Gum Arabic (1:2)	2¾ "
Water	5½ dr.

Perfume to be added in the proportion of 2½ dr. per pound.

196. Perfume for Beard Fixative

Bergamot Oil	4 oz.
Clove Oil	4 "
Lemon Oil	8 "
	1 lb.

C. Soap Perfumes

The soap perfumes consist chiefly of volatile oils or synthetic odorous compounds with the occasional addition of alcohol. They are all, without exception, so made that ½ oz. is required per hundredweight of soap.

I. HOUSEHOLD SOAPS

197. Soap Perfume, I

Lemongrass Oil	4 oz.
Cassia Oil	4 "
Citronella Oil	8 "
	1 lb.

198. Soap Perfume, II

Citrene	4 oz.
Citronella Oil	12 "
	1 lb.

199. Soap Perfume, III

Cedar Oil	3½ oz.
Caraway Oil	3½ "
Thymene	3½ "
Safrol	5½ "
	1 lb.

200. Soap Perfume, IV

Caraway Oil	2½ oz.
Lavender Oil	3½ "
Gingergrass Oil	3½ "
Thymene	6½ "
	1 lb.

201. Soap Perfume, V

Mirbane Oil	½ oz.
Caraway Oil	4 "
Cassia Oil	4 "
Bergamot Oil	7½ "
	1 lb.

202. Soap Perfume, VI

Mirbane Oil	½ oz.
Caraway Oil	2½ "
Bergamot Oil	5 "
Peppermint Oil, Japanese	8 "
	1 lb.

II. ORDINARY SOAPS

203. Bitter Almond

Benzaldehyde	4 oz.
Bergamot Oil	12 "
	1 lb.

204. Honey

Peppermint Oil	2½ oz.
Clove Oil	5 "
Citronella Oil	8½ "
	1 lb.

205. Rose

Cassia Oil	1½ oz.
Gingergrass Oil	3 "
Bergamot Oil	5½ "
Geranium Oil	6 "
	1 lb.

206. Violet

Musk Tincture	½ oz.
Rose Geranium Oil	1½ "
Clove Oil	1½ "
Lavender Oil	6 "
Cassia Oil	6½ "
	1 lb.

207. Brown Windsor

Anise Oil	1½ oz.
Caraway Oil	7 "
Bergamot Oil	7½ "
	1 lb.

208. White Windsor

Clove Oil	2½ oz.
Cassia Oil	5 "
Caraway Oil	8½ "
	1 lb.

III. TOILET SOAPS

209. Toilet Soap, I

Musk	6 dr.
Benzaldehyde	6 "
Rose Geranium Oil	3¼ oz.
Geranium Oil	4 "
Gingergrass Oil	4 "
Verbena Oil	4 "
	1 lb.

210. Toilet Soap, II

Musk	½ oz.
Clove Oil	1½ "
Caraway Oil	2½ "
Cinnamon Oil	3 "
Lavender Oil	4 "
Geranium Oil	4½ "
	1 lb.

211. Acacia

Cumarin	1¼ dr.
Vanillin	5¾ "
Yara-Yara	7 "
Clove Oil	7⅛ oz.
Petitgrain Oil	8 "
	1 lb.

212. Alpine Flowers

Thyme Oil	1⅛ oz.
Rosemary Oil	2 "
Lavender Oil	2¼ "
Peppermint Oil	2¼ "
Sage Oil	2⅜ "
Lemon Oil	6 "
	1 lb.

213. Bitter Almond

Bergamot Oil	1 oz.
Lavender Oil	1½ "
Benzaldehyde	13½ "
	1 lb.

214. Bouquet of Flowers

Musk	¾ oz.
Benzaldehyde	1½ "
Lavender Oil	4 "
Lemon Oil	4 "
Gingergrass Oil	5¾ "
	1 lb.

215. Almond Bran

Bergamot Oil	2½ oz.
Benzaldehyde	13½ "
	1 lb.

216. Chocolate

Vanillin	⅜ oz.
Cassia Oil	4 "
Clove Oil	5⅝ "
Peru Balsam	6 "
	1 lb.

217. Eau de Cologne

Musk Tincture	1 oz.
Clove Tincture	1½ "
Santal Oil	1½ "
Lemongrass Oil	2½ "
Cedar Oil	2½ "
Rose Geranium Oil	7 "
	1 lb.

218. Eucalyptus

Eugenol	1 oz.
Terpineol	2 "
Geraniol	4 "
Eucalyptus Oil	9 "
	1 lb.

219. Guimauve

Peppermint Oil	¼ oz.
Verbena Oil	1 "
Petitgrain Oil	2 "
Lemon Oil	2 "
Lavender Oil	10¾ "
	1 lb.

220. Flower

Cassia Oil	5 dr.
Clove Oil	5 "
Lavender Oil	10 "
Petitgrain Oil	12 "
Musk Tincture	1 oz.
Cedar Oil	2 "
Bergamot Oil	11 "
	1 lb.

221. Heliotrope

Musk Tincture	¾ oz.
Lavender Oil	1½ “
Rose Geranium Oil	2 “
Bergamot Oil	2¾ “
Clove Oil	4 “
Peru Balsam	5 “
	1 lb.

222. Herbs

Peppermint Oil	8 oz.
Calamus Oil	8 “
	1 lb.

223. Hyacinth

Musk Tincture	½ oz.
Benzaldehyde	1½ “
Cassia Oil	6 “
Styrax Tincture	8 “
	1 lb.

224. Lavender

Ambergris Tincture	2½ oz.
Lavender Oil	13½ “
	1 lb.

225. Lilac

Rose Geranium Oil	2 oz.
Cananga Oil	4 “
Terpineol	10 “
	1 lb.

226. Lily Milk

Patchouly Oil	7 dr.
Benzaldehyde	9 “
Clove Oil	1 oz.
Lavender Oil	2 “
Lemon Oil	2 “
Petitgrain Oil	2 “
Bergamot Oil	2 “
Geranium Oil	6 “
	1 lb.

227. Linden Flowers

Cananga Oil	10 dr.
Anise Oil	10 “
Musk Tincture	1 oz.
Fennel Oil	1½ oz.
Lavender Oil	1½ “
Gingergrass Oil	3 “
Lemon Oil	7¾ “
	1 lb.

228. Lily of the Valley

Musk Tincture	10 dr.
Cananga Oil	1 oz.
Linaloe Oil	5 “
Terpineol	9⅜ “
	1 lb.

229. Milk

Lavender Oil	1½ oz.
Benzoin Tincture	2½ “
Linaloe Oil	5 “
Bergamot Oil	7 “
	1 lb.

230. Millefleurs

Clove Oil	4 dr.
Cassia Oil	4 “
Musk Tincture	12 “
Lavender Oil	12 “
Petitgrain Oil	1 oz.
Cedar Oil	2 “
Bergamot Oil	11 “
	1 lb.

231. Musk

Clove Oil	10 dr.
Cinnamon Oil	10 “
Lavender Oil	12 “
Bergamot Oil	2 oz.
Spike Oil	2 “
Cedar Oil	2½ “
Sassafras Oil	2½ “
Musk Tincture	5 “
	1 lb.

232. New Mown Hay

Musk	1 oz.
Cumarin	2 “
Thymene	2 “
Lavender Oil	5 “
Bergamot Oil	6 “
	1 lb.

233. Patchouly

Cassia Oil	2½ oz.
Rose Geranium Oil	2½ "
Lemongrass Oil	5 "
Patchouly Oil	6 "
	1 lb.

234. Peach Flowers

Clove Oil	2½ oz.
Fennel Oil	2½ "
Benzaldehyde	2½ "
Rose Geranium Oil	3½ "
Bergamot Oil	5 "
	1 lb.

235. Pinks

Citronella Oil	2 oz.
Santal Oil	2 "
Lemongrass Oil	4 "
Lemon Oil	8 "
	1 lb.

236. Reseda

Patchouly Oil	6 dr.
Peru Balsam	1 oz.
Citronella Oil	1⅝ "
Styrax Solution	2½ "
Lavender Oil	2½ "
Geranium Oil	8 "
	1 lb.

237. Red Rose

Benzaldehyde	5 dr.
Musk Tincture	11 "
Bergamot Oil	4 oz.
Gingergrass Oil	5 "
Geranium Oil	6 "
	1 lb.

238. White Rose

Vetiver Oil	2½ dr.
Lavender Oil	3½ "
Musk Tincture	10 dr.
Lemon Oil	3½ oz.
Bergamot Oil	5 "
Geranium Oil	6½ "
	1 lb.

239. Strawberry

Yara-Yara	1 oz.
Amyl Acetate	2½ "
Clove Oil	3¾ "
Terpineol	4 "
Geranium Oil	5 "
	1 lb.

240. Vanilla

Rose Geranium Oil	1 oz.
Clove Oil	1¼ "
Lavender Oil	1¼ "
Peru Balsam	2½ "
Benzoin Tincture	5 "
Vanillin Tincture	5 "
	1 lb.

241. Violet

Musk	2 dr.
Ceylon Cinnamon	6 "
Ionone	1¼ oz.
Peru Balsam	1¼ "
Sassafras Oil	2½ "
Bergamot Oil	4 "
Lavender Oil	6½ "
	1 lb.

242. Ylang-Ylang

Musk Tincture	1½ oz.
Geranium Oil	1½ "
Niobe Oil	3 "
Cananga Oil	10 "
	1 lb.

IV. MILLED SOAPS

243. Almond Flowers

Musk	1 dr.
Benzyl Acetate	5 oz.
Benzaldehyde	11 "
	1 lb.

244. Bitter Almond

Geranium Oil	1½ oz.
Bergamot Oil	1½ "
Benzaldehyde	13 "
	1 lb.

245. Cananga

Musk	1 dr.
Bergamot Oil	3 oz.
Lavender Oil	5 "
Cananga Oil	8 "
	1 lb.

246. Chypre

Patchouly Oil	1 dr.
Niobe Oil	1½ "
Cumarin	5½ "
Orris Oil, Concrete	6 "
Hyacinthin	8 "
Vanillin	10 "
Rose Oil	1 oz.
Rose Geranium Oil	2½ "
Bergamot Oil	4 "
Musk Tincture	6½ "
	1 lb.

247. Eau de Cologne

Zibethin	1½ dr.
Ylang-Ylang Oil	10½ "
Rosemary Oil	1 oz.
Neroli Oil	1 "
Lavender Oil	5¼ "
Bergamot Oil	8 "
	1 lb.

248. Ess Bouquet

Musk	1 dr.
Zibethin	2½ "
Vetiver Oil	2½ "
Aubépine	4 "
Geranium Oil	10 "
Benzyl Acetate	1½ oz.
Peru Balsam	1½ "
Clove Oil	1½ "
Bergamot Oil	3¾ "
Lavender Oil	6½ "
	1 lb.

249. Florida Water

Vanillin	2½ dr.
Vetiver Oil	7½ "
Rosemary Oil	2 oz.
Thyme Oil	2 "
Cassia Oil	3 "
Lavender Oil	3⅜ "
Bergamot Oil	5 "
	1 lb.

250. Frangipanni

Zibethin	1 oz.
Geranium Oil	1 "
Neroli Oil	1 "
Vetiver Oil	2 "
Santal Oil	11 "
	1 lb.

251. Heliotrope

Vanillin	5 dr.
Benzaldehyde	7 "
Benzyl Chloride	12 "
Peru Balsam	3½ oz.
Heliotropin	5 "
Terpineol	6 "
	1 lb.

252. Honey

Hyacinthin	1¼ dr.
Zibethin	1¼ "
Vanillin	2½ "
Neroli Oil	5 "
Lavender Oil	6 "
Geranium Oil	15 oz.
	1 lb.

253. Indian Flowers

Musk	¼ dr.
Zibethin	¼ "
Vetiver Oil	2½ "
Rose Oil	7 "
Patchouly Oil	10 "
Portugal Oil	1⅛ oz.
Santal Oil	1⅛ "
Verbena Oil	1½ "
Rose Oil, Artificial	1½ "
Geranium Oil	9½ "
	1 lb.

254. Jockey Club

Musk	2½ dr.
Cassia Oil	5½ "
Hyacinthin	¼ oz.
Jasmine Oil, Artificial	1¼ "
Rose Oil, Artificial	4 "
Geranium Oil	4 "
Clove Oil	6 "
	1 lb.

255. Lavender

Zibethin	2½	dr.
Ylang-Ylang Oil	5	"
Santal Oil	5	"
Cananga Oil	5	"
Benzyl Acetate	6½	"
Bergamot Oil	2½	oz.
Lavender Oil	12	"
	1	lb.

256. Lettuce (Laitue)

Zibethin	1	dr.
Musk	5	"
Safrol	1⅝	oz.
Petitgrain Oil	3	"
Bergamot Oil	4	"
Lavender Oil	7	"
	1	lb.

257. Lilac

Musk	1¼	dr.
Aubépine	2½	"
Vanillin	3½	"
Benzaldehyde	8¾	"
Ylang-Ylang Oil	3	oz.
Geranium Oil	4	"
Terpineol	8	"
	1	lb.

258. Lily Milk

Musk	1¼	dr.
Benzaldehyde	2¼	"
Patchouly Oil	2½	"
Eugenol	5	"
Rose Oil	5	"
Lavender Oil	1½	oz.
Petitgrain Oil	1½	"
Lavender Oil	1½	"
Bergamot Oil	2½	"
Geranium Oil	8	"
	1	lb.

259. Lily of the Valley

Zibethin	1¼	dr.
Ylang-Ylang	2¾	oz.
Terpineol	3¼	"
Linalool	5	"
Bergamot Oil	5	"
	1	lb.

260. Millefleurs

Patchouly Oil	4	dr.
Oil Rose Geranium	6	"
Cassia Oil	6	"
Peru Bal am	2	oz.
Pimenta Oil	2	"
Lemon Oil	3½	"
Lavender Oil	3½	"
Bergamot Oil	4	"
	1	lb.

261. Musk

Vetiver Oil	4	dr.
Musk	10	"
Cassia Oil	10	"
Santal Oil	4½	oz.
Geranium Oil	10	"
	1	lb.

262. New Mown Hay

Musk	½	dr.
Orris Oil, Concrete	2	"
Neroli Oil	13½	"
Bergamot Oil	4	oz.
Lavender Oil	5	"
Cumarin	6	"
	1	lb.

263. Peau d'Espagne

Zibethin	5	dr.
Vetiver Oil	5	"
Patchouly Oil	8	"
Vanillin	10	"
Cassia Oil	1	oz.
Cananga Oil	1¼	"
Bergamot Oil	1¼	"
Cinnamon Oil	1½	"
Santal Oil	2	"
Geranium Oil	2¼	"
Peru Balsam	2½	"
Castor Tincture	2½	"
	1	lb.

264. Pinks

Musk	1¼	dr.
Cassia Oil	7¾	"
Ylang-Ylang Oil	11	"
Rose, Oil, Artificial	1¼	oz.
Clove Oil	5½	"
Benzoin Tincture	7	"
	1	lb.

265. Rose

Musk	1¼ dr.
Vetiver Oil	2¾ "
Hyacinthin	5 "
Santal Oil	5 "
Rose Oil, Artificial	10 "
Geranium Oil	14½ oz.
	1 lb.

266. Tea Rose

Musk	1¼ dr.
Vetiver Oil	2¾ "
Patchouly Oil	4 "
Neroli Oil	7 "
Rose Oil	9 "
Petitgrain Oil	1 oz.
Geranium Oil	13½ "
	1 lb.

267. White Rose

Zibethin	1½ dr.
Patchouly Oil	3 "
Rose Oil	3½ "
Jasmine Oil, Artificial	1 oz.
Neroli Oil, Artificial	1½ "
Geranium Oil	13 "
	1 lb.

268. Sweet Pea

Vanillin	4 dr.
Benzyl Acetate	10 "
Portugal Oil	10 "
Geranium Oil	3 oz.
Cananga Oil	3½ "
Petitgrain Oil	3½ "
Styrax Solution	4½ "
	1 lb.

269. Trèfle

Citral	2½ dr.
Musk	2½ "
Jasmine Oil, Artificial	11 "
Cumarin	1 oz.
Linalyl Acetate	1 "
Geranium Oil	2¼ "
Niobe Oil	3¼ "
Benzyl Acetate	3½ "
Terpineol	4 "
	1 lb.

270. Violet

Musk	1 dr.
Orris Oil, Concrete	2¼ oz.
Vanillin Tincture	3 "
Ylang-Ylang Oil	4 "
Bergamot	5¾ "
	1 lb.

271. Violet, Nizza

Zibethin	6 dr.
Rose Oil	6 "
Orris Oil, Concrete	1¼ oz.
Jasmine Oil, Artificial	1¼ "
Neroli Oil, Artificial	2¾ "
Bergamot Oil	10 "
	1 lb.

272. Ylang-Ylang

Zibethin	1 dr.
Orris Oil, Concrete	5 "
Jasmine Oil, Artificial	1⅝ oz.
Eugenol	2¾ "
Lavender Oil	3¼ "
Bergamot Oil	3½ "
Ylang-Ylang Oil	4½ "
	1 lb.

V. TRANSPARENT SOAPS

273. Glycerin, I

Bergamot Oil	1⅛ oz.
Citronella Oil	2⅜ "
Cananga Oil	3 "
Clove Oil	3½ "
Lavender Oil	6 "
	1 lb.

274. Glycerin, II

Thyme Oil	10 dr.
Cassia Oil	14 "
Clove Oil	1½ oz.
Lavender Oil	6 "
Safrol	7 "
	1 lb.

275. Glycerin, III

Geranium Oil	1¼ oz.
Cassia Oil	6¾ "
Lavender Oil	8 "
	1 lb.

276. Heliotrope

Benzaldehyde		1¼ dr.
Vanillin		3¾ "
Heliotropin	4 oz.	11 "
Alcohol	11 "	
	1 lb.	

277. Lily of the Valley

Benzyl Acetate	4 dr.
Ylang-Ylang Oil	2¾ oz.
Linaloe Oil	5 "
Lavender Oil	8 "
	1 lb

278. New Mown Hay

Cumarin	1⅛ oz.
Geranium Oil	2⅞ "
Lavender Oil	6 oz.
Alcohol	6 "
	1 lb.

279. Reseda

Orris Oil, Concrete	4 dr.
Petitgrain Oil	5 oz.
Bergamot Oil	10¾ "
	1 lb.

280. Rose

Patchouly Oil	4 dr.
Lavender Oil	5 oz.
Geranium Oil	10¾ "
	1 lb.

281. Violet

Orris Oil, Concrete	4 dr.
Ionone	4 "
Neroli Oil	8 "
Geranium Oil	1 oz.
Jasmine Oil, Artificial	1 "
Bergamot Oil	13 "
	1 lb.

VI. LIQUID SOAPS

282. Glycerin Soap

Citronella Oil	¾ oz.
Benzaldehyde	¾ "
Clove Oil	¾ "
Wintergreen Oil	1¼ "
Sassafras Oil	1½ "
Geranium Oil	1½ "
Cinnamon Oil	1½ "
Musk Tincture	4 "
Bergamot Oil	4 dr.
	1 lb.

283. Toilet Soap

Benzaldehyde	5 dr.
Aubépine	11 "
Bergamot Oil	3½ oz.
Heliotropin	3½ "
Terpineol	8 "
	1 lb.

VII. SHAVING SOAPS

284. Shaving Soap

Cassia Oil	1 oz.
Cinnamon Oil	1½ "
Rose Geranium Oil	2½ "
Geranium Oil	11 "
	1 lb.

285. Shaving Cream, Rose

Rose Oil	1 oz.
Santal Oil	1 "
Musk Tincture	3½ "
Clove Oil	5 oz.
Geranium Oil	5½ "
	1 lb.

286. Shaving Cream, Violet

Musk	½ oz.
Ionone	1½ "
Orris Oil, Concrete	3½ "
Bergamot Oil	10½ "
	1 lb.

VIII. SKIN CREAMS

287. Lanolin

Zibethin	2½ dr.
Vetiver Oil	6 "
Benzyl Acetate	7 "
Cassia Oil	8½ "
Bergamot Oil	2 oz.
Geranium Oil	12½ "
	1 lb.

288. Lanolin Cold Cream

Eucalyptus Oil	1 oz.
Lavender Oil	1½ "
Bergamot Oil	3 oz.
Clove Oil	3¼ "
Linaloe Oil	3¼ "
Geranium Oil	4 "
	1 lb.

289. Vaseline

Musk Tincture	7 dr.
Benzaldehyde	9 "
Caraway Oil	2½ oz.
Rose Geranium Oil	5 "
Geranium Oil	7½ "
	1 lb.

IX. MEDICATED SOAPS

The perfumes for these serve only to cover any odor due to the dded remedial agent, or as a general perfume which may be used ithout any special rules.

290. Borax Soap

Citronella Oil	1½ oz.
Bergamot Oil	7 "
Lemon	7½ "
	1 lb.

291. Pine Needle

Vermouth Oil	½ oz.
Clove Oil	1½ "
Eucalyptus Oil	3½ "
Pine Needle Oil	10½ "
	1 lb.

292. Pumice Stone

Peppermint Oil	1¼ oz.
Caraway Oil	1¼ "
Rosemary Oil	5 oz.
Lavender Oil	8½ "
	1 lb.

293. Salicylated Soap

Musk Tincture	½ oz.
Lavender Oil	3½ "
Geranium Oil	12 "
	1 lb.

294. Tannin Soap

Bergamot Oil	3¼ oz.
Lavender Oil	3¼ "
Geranium Oil	2¼ "
Musk Tincture	6¼ "
	1 lb.

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